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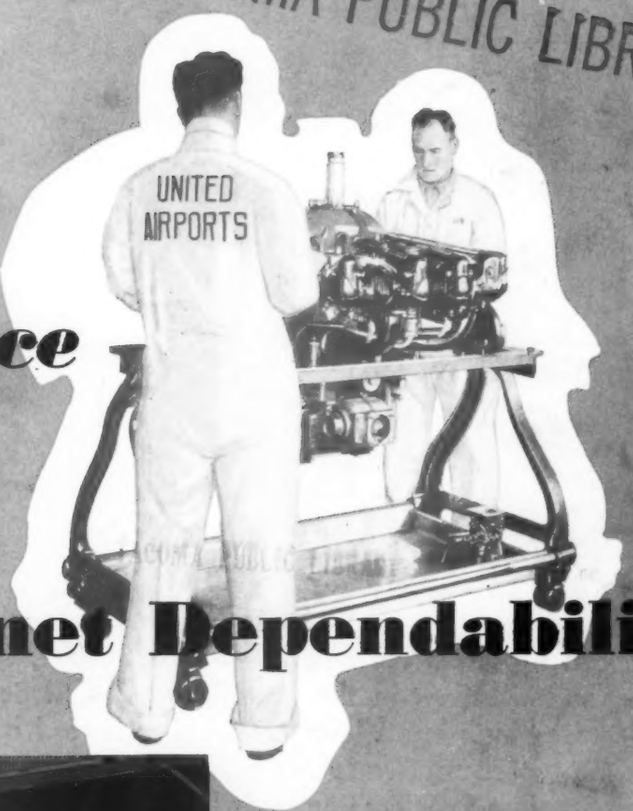

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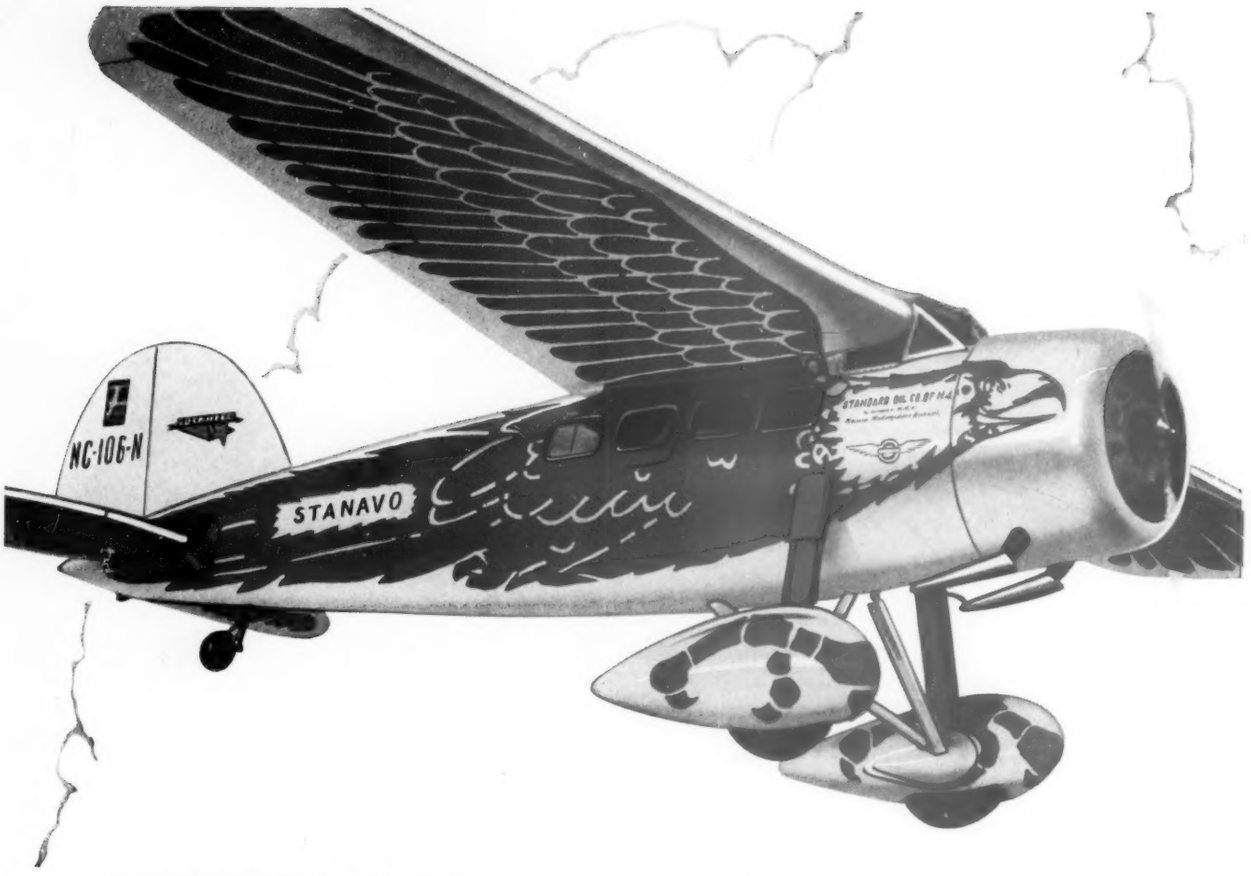

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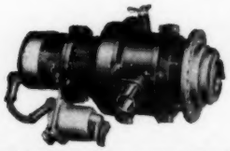

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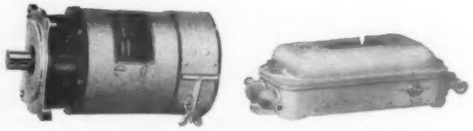

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AVIATION

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The Oldest American Aeronautical Magazine

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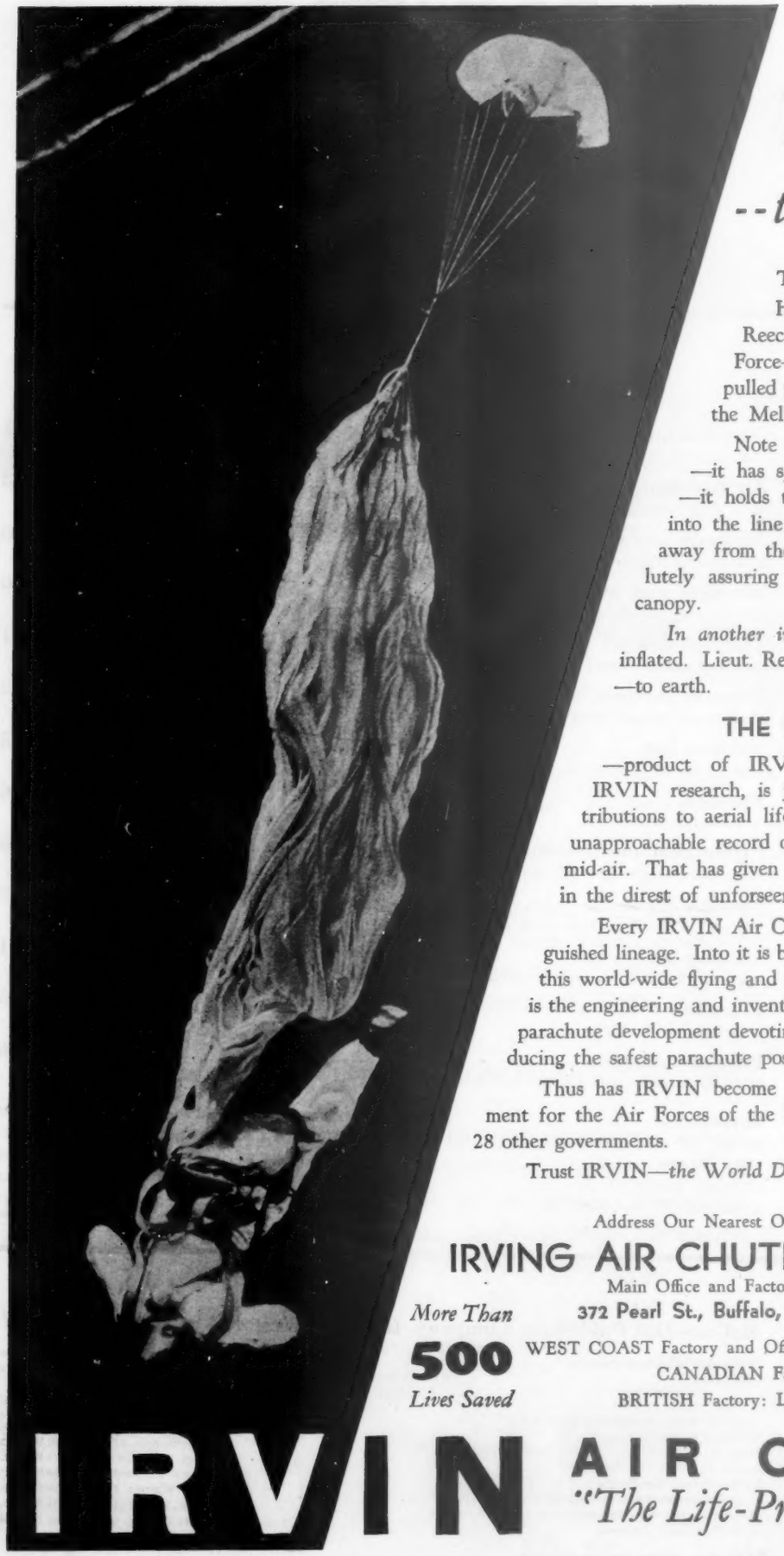

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When another Autogiro recently landed on a New York pier to meet Juan de la Cierva, its inventor, upon his arrival from Europe, and took off again with him for Philadelphia, it was merely another demonstration of the ability of the Autogiro to directly link air and water transportation.

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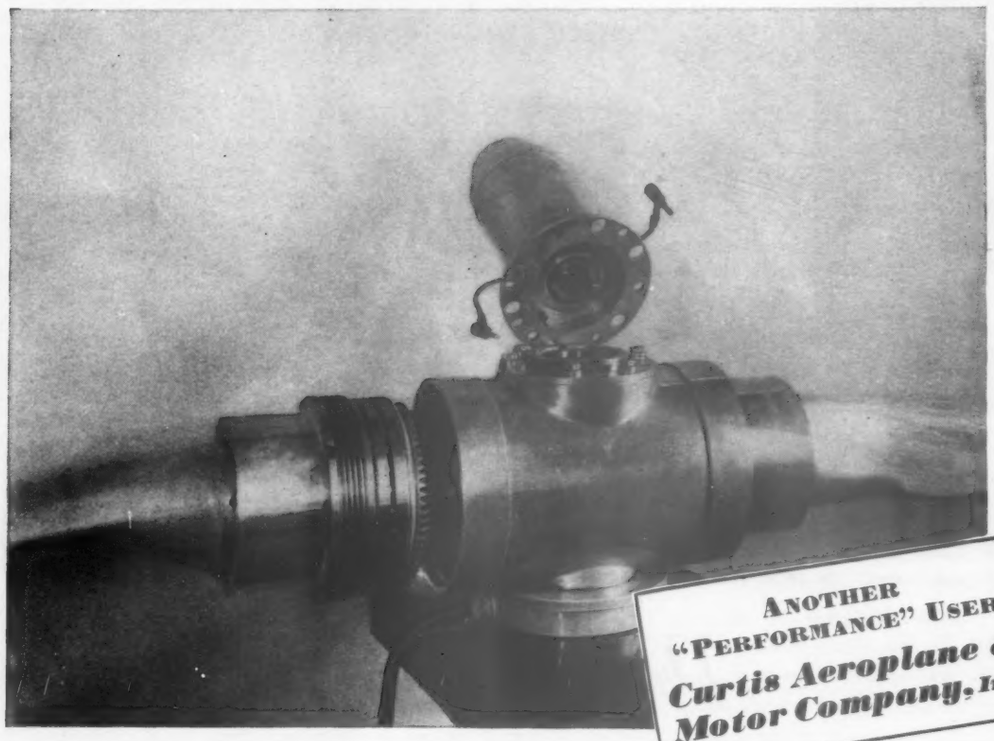

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The great success of the Ford tri-motored, all-metal plane, which pioneered the airways, plainly indicates the future Ford. Larger Ford planes will soon lead the way.

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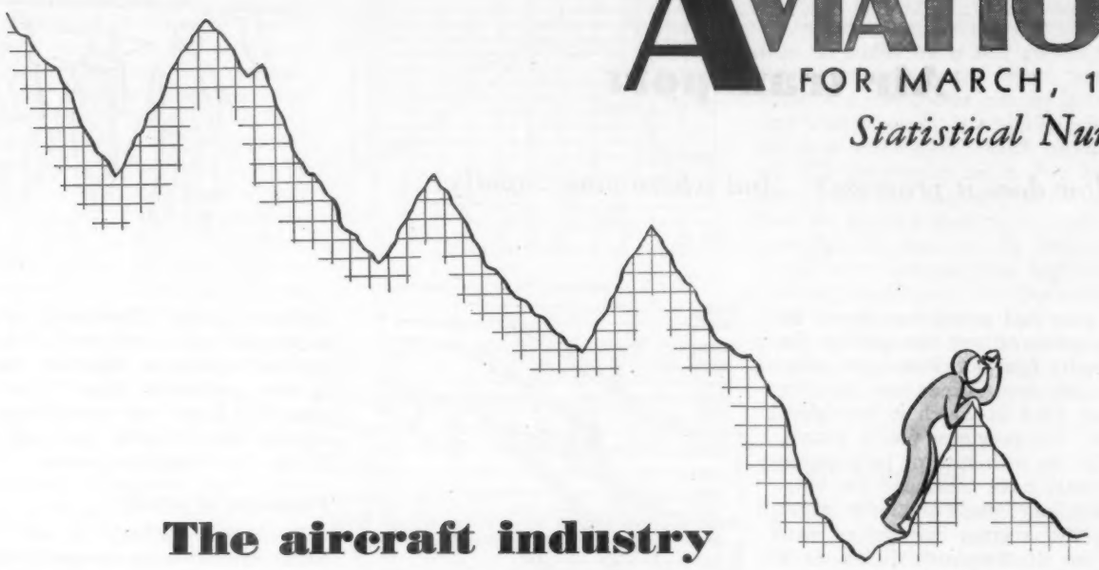

The aircraft industry reads its future in the figures

THIS is the fourth statistical issue of AVIATION. A number of points are here covered for the first time—some of them, we believe, for the first time in the history of American aeronautics. The problem of preparing such a compilation grows more acute as the sources grow more varied and scattered, but the usefulness of the result ought also to be steadily increasing. It is possible to learn a great deal by a comparison with the record of past years that could not possibly be drawn from any single study, however complete.

There are a few features to which we want to invite special attention, because of our conviction that they deserve it, and that the information set forth and the conclusions drawn are of immediate importance and immediate use to the operators and manufacturers of aircraft in making their current decisions.

Thus, for example, the studies of density of passenger traffic and of frequency on air transport lines, particularly the former. They appear on pages 104 and 105. A glance at the maps will show where centers of gravity of public interest lie, and how successful the policies of the various operators have been in developing public patronage.

Of great interest to transport operators, also, is the analysis of governmental expenditures on civil aviation and the relation to the development of traffic in all the leading air powers of the world, printed on page 136.

Builders of planes for military use, government officials, and the plain citizen interested in the development of military aviation will find on page 134 what we believe is the most complete tabulation recently published in English of the military and naval activities of all the countries of the world.

For manufacturers for commercial account, and for distributors, dealers and operators of flying services we set forth on page 125 an examination, based on three successive years of close analysis of all licensed aircraft, into the vexed question of average life and of rate of replacement of machines in various classes of service. It is supplemented by a study, the first of its kind, of the classification of airplane owners and of the types of craft that each group has favored. That appears on page 126.

After pointing with a modest degree of pride to a few of the high spots of the issue, there remain two obligations—to make grateful acknowledgment of assistance and to confess the virtual certainty of occasional errors—we hope minor ones. The first obligation is a very pleasant one, indeed. As usual, our principal debt is to the Department of Commerce and the Aeronautical Chamber of Commerce. The Aeronautics Branch, the Aeronautical Trade Division of the Bureau of Foreign and Domestic Commerce, and the Chamber of Commerce have all been helpful in the extreme. They have been generous in putting original material at our disposal, that we might make our own analyses. We are equally appreciative of the assistance of the National Advisory Committee for Aeronautics, the Army Air Corps, the Naval Bureau of Aeronautics, and a number of other government departments and offices—of the unstinting cooperation of the Canadian Director of Civil Aviation and of the information furnished in direct correspondence by some twenty foreign governments—of the efforts of some 700 airport managers and flying service operators in the United States who have responded to our questions about their own activities. The work could not have been done without everyone's help. We hope that those who have helped will find the results of enough interest to justify the trouble that they have taken.

It is impossible to hope that so extensive a compilation, necessarily made under great pressure of time, will be entirely free from error. In past years we have been fortunate in avoiding errors having any important effect upon the conclusions, and we hope that we shall be equally fortunate this time. We shall greatly appreciate it if any reader will bring to our attention any slips that he discovers, and we shall be glad to correct in succeeding issues of AVIATION any that seem to be of significance.

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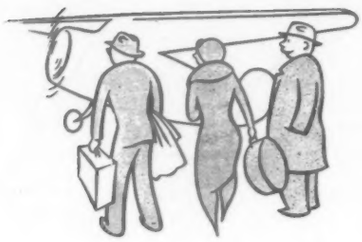
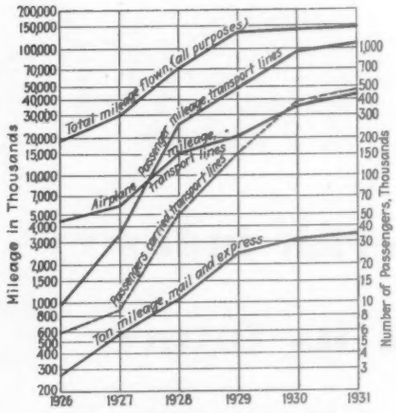


Air transport

How does it progress? And where most rapidly?

THE year just passed has shown no very extraordinary changes in the air transport figures. Passenger mileage increased some 20 per cent, the first year since 1925 in which it has failed to double the previous year's record. Obviously, no such rate of progression as that could have continued for long. Airplane mileage made a slightly larger increase, the average number of passengers in all transport flights as a whole (including those on which no passengers were carried) remaining between two and one-half and three. The number of passengers carried increased by 19 per cent. The average haul per passenger was therefore almost exactly the same as in 1930.

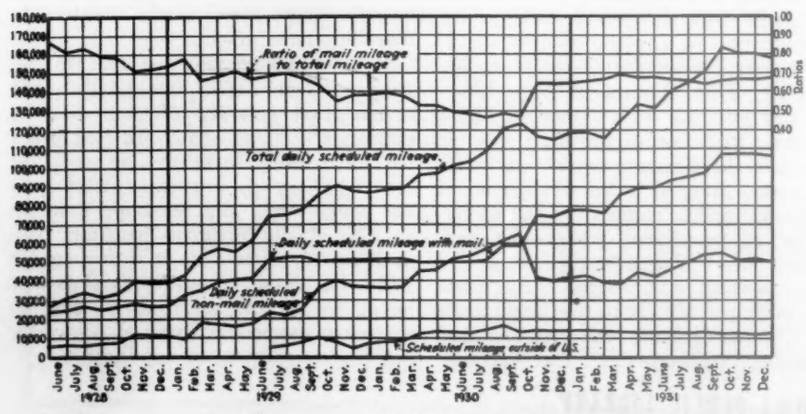
There are no official statistics in the United States which give an accurate basis for the calculation of the ton-mileage of mail and express. Even an approximation is better than no figures on that point, however, and an approximation has been secured by estimating the average distance traveled by the average piece of mail on each mail route in each of the past five years, figuring the ton-mileage for each one, and summing up to get a total. It appears that in the aggregate the ton-mileage represented by passenger traffic is about 78 per cent of the total of transport business, an increase from 38 per cent in 1927. For demanding 78 per cent of the service, however, passengers in the aggregate furnished the transport lines with only about 21 per cent of their income. Roughly speaking, passenger traffic in 1932 was compensated for at 65 cents a ton-mile, mail traffic at $8 a ton-mile.



Transport operations and total flying, year by year

As usual, most of the increase in mileage was made during the summer months, and there was a slight seasonal drop in mileage scheduled daily during the winter. Contrary to what is perhaps a general supposition, the proportion of transport flying represented by mail operations did not decrease during the year, but remained almost exactly constant at .66. The nature of the non-mail mileage, however, changed considerably. More independents came into the field, and their coming was to some extent compensated for by the abandonment by some of the mail contractors of certain non-mail-carrying schedules. The line of division between mail-carrying and non-mail-carrying operators was more sharply drawn.

The American-flag mileage outside the United States appears on the chart as having been almost constant for eighteen months. Operations are, however, much more concentrated and carried on with more regularity now than in the summer of 1930. The mileage actually flown in accordance with schedule has probably increased at least 25 per cent since that time.



Four years of air transport growth

Frequency of service

Passenger airlines in the United States are still on a one-trip-a-day-basis in most cases, as the map at the top of page 105 graphically reminds us. With a service so infrequent as that, only a smattering of the passengers can be caught, those whose desires and other obligations happen to coincide with the airline's schedule. There are only about 5,500 miles in the United States over which more than two round trips per day are offered for passengers. Really high frequency is confined to some 1,200 miles of route, well scattered over the country.

There is much less to complain of in respect of air mail frequency (mapped on page 104). It is hardly possible to secure better than over-night service on letters in any event, and two or three schedules a day are generally enough to give a close approximation to the best mail service that could be hoped for under any conditions.

Roughly speaking, three schedules a day are as good for mail as six or eight are for passenger service over a short route. It is of course natural that the air mail map should show a better balance, and a more uniform schedule adjustment, than the passenger layout, since the mail lines are all under the central control of the Post Office Department and can be planned as a whole. Most of the first-class trunk lines now have at least two schedules a day, and many of them have three.

Passengers per route

ON the lower part of page 105 general is what is believed to be the first analysis of volume of air passenger traffic that has ever been prepared in graphical form for the United States. It has necessarily been based only on the first six months of 1931, the returns for the last half not yet being available, but a map for the whole year would show no great changes except for considerable increases in density of traffic between Cleveland, Detroit, and Chicago, and between Los Angeles and San Francisco.

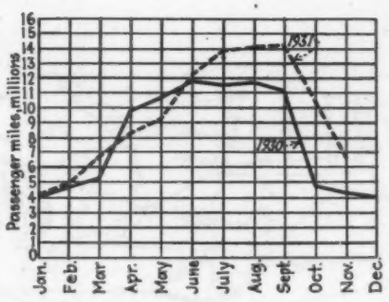
The form in which reports are now made to the Department of Commerce makes it impossible to divide the traffic accurately in respect to the individual parts of the various lines. It has been necessary, for example, to assume that the travel on the Boeing line is uniformly distributed from Chicago to San Francisco. The weight of the lines on the map, however, is not based simply on the total number of passengers flying over some part of the line. Due allowance is made for the fact that many of them travel only a limited part of the total length. The figure of passenger-miles, rather than that of total passengers, has been used as a basis of calculation, and the only remaining error is in the assumption that on T.&W.A., for example, there are just as many passengers in the aggregate on the stretch between Kingman and Albuquerque as between St. Louis and Columbus. While some error is involved in such an assumption, it is not believed that it is very serious, or that it is at all appreciable except in a few cases. No doubt other errors have crept in at some points. The special value of such a map, however, is not in its exact numerical interpretation, but in that it permits the gaining of a general idea of the general mass of traffic and shows which territories are being best exploited. The presentation on page 105 will, we believe, prove admirably suited for that purpose.

The width of the lines on the map could not be made directly proportional to the volume of traffic where the traffic was very heavy, as it would have required blacking in so large a part of the map as to be very obscure. The weight of line used for any number of passengers up to ten per day is indicated on the map itself. Beyond ten it was made proportional to the square root of the number of passengers, the line for 90 passengers per day, for example, being three times as wide as that for ten. The individual routes and parts of routes having the heaviest traffic are:

Passengers carried per day

New York-Philadelphia	188
Philadelphia-Washington	172
San Francisco-Alameda (7 miles)	57
Cleveland-Detroit	53
New York-Boston	47
Cleveland-Chicago	41
Seattle-Bremerton (15 miles)	35
Miami-Havana	31
Chicago St. Louis	26
San Francisco-Los Angeles	26

The remarkable degree to which air traffic is concentrated on half a dozen general trade routes is well shown by the map. The heaviest flow of all is along the Atlantic Coast between Boston and Washington. Next comes the Lake area, involving Cleveland, Detroit, and Chicago. Those two sections, together with two main transcontinental routes,



Seasonal shift of passenger travel

the southwesterly course from Chicago through St. Louis and Kansas City to Dallas and Galveston, that northwesterly from Chicago to the Twin Cities, and the route between San Francisco and Los Angeles, include all the operations in the country that were averaging as many as seven passengers per day in the first half of last year.

A comparison of traffic for the same period in the previous year has been made for a few of the major routes.

Average number of passengers (carried daily)

	First half 1930	First half 1931
New York-Boston	34	47
New York-Washington	0	172
New York-Chicago	0	21
Cleveland-Detroit	72	53
Cincinnati-Chicago	15	6
Chicago-St. Paul	12	22
Kansas City-Los Angeles	19	13
Los Angeles-San Francisco	42	26
San Francisco-Alameda	211	57
Miami-Havana	20	31

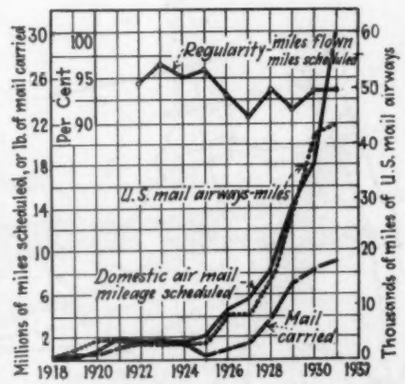
There has been a general falling off in traffic on the routes that were most popular in the early part of 1930, such as Cleveland-Detroit and Los Angeles-San Francisco, and new favorites like New York-Washington and New York-Chicago have come to take place among the leaders. It appears, however, that that trend is in some instances being reversed. Thus, the traffic between Los Angeles and San Francisco rose to a high of 80 passengers per day average over the last half of 1930 and dropped to one-third of that figure in the next six months. Since then two new lines have been started, and there has been a decided improvement in traffic. Whether or not it has yet regained the level of eighteen months ago cannot yet be determined.

Aside from the extraordinarily light passenger traffic on many of the lines which have long been in operation, perhaps the most surprising feature of the map is the heavy movement of passengers to the south. Only six or eight routes in the United States exceed that between Miami and Havana in the number of passengers carried per day, and the line from Brownsville to Mexico City ranks well up above the majority of those in the continental United States in traffic density.

On the whole, the extreme concentration of traffic on a few routes is distinctly encouraging. What has been done on a few routes can, in due course and with more or less similar methods, be done elsewhere. With an average of 172 passengers each day between New York and Washington it is ridiculous to suppose that 53 on the Cleveland-Detroit run, or 26 between St. Louis and Chicago, even approach the limiting possibilities of the territories. Still more absurd are the lines on the map showing one or two passengers a day over a number of routes, both east and west, of excellent traffic possibilities.

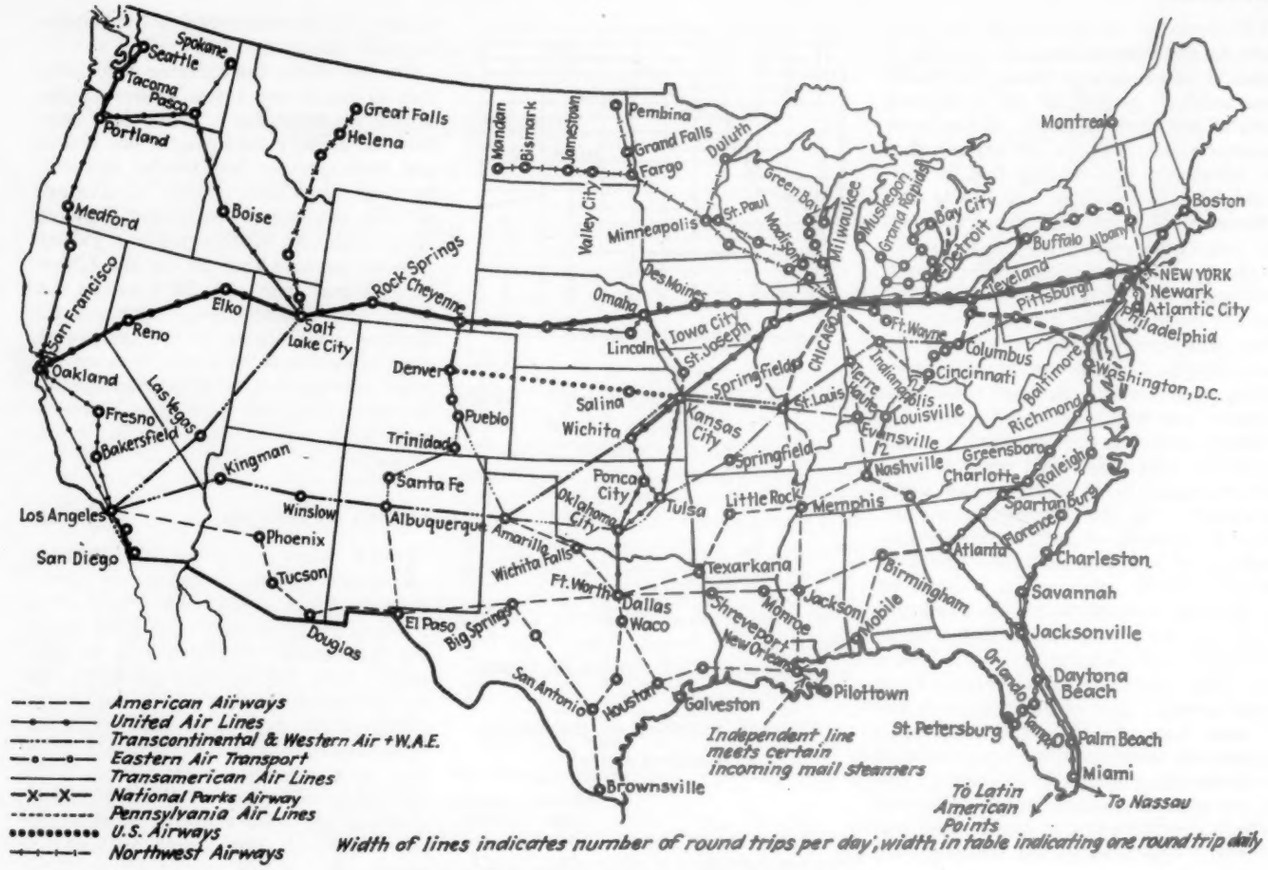
Group ownership

THE maps on page 104 showing ownership and frequency of operation of the air mail lines and of a limiting group of passenger lines, speak for themselves. In the case of the passenger lines only the five operators who fly the largest mileage within the United States each day have been included. The passenger map is particularly striking as a reminder that, although the allocation of routes by the Postmaster General has been effective in eliminating most of the direct competition among the major operators for passenger business, there remains a vast

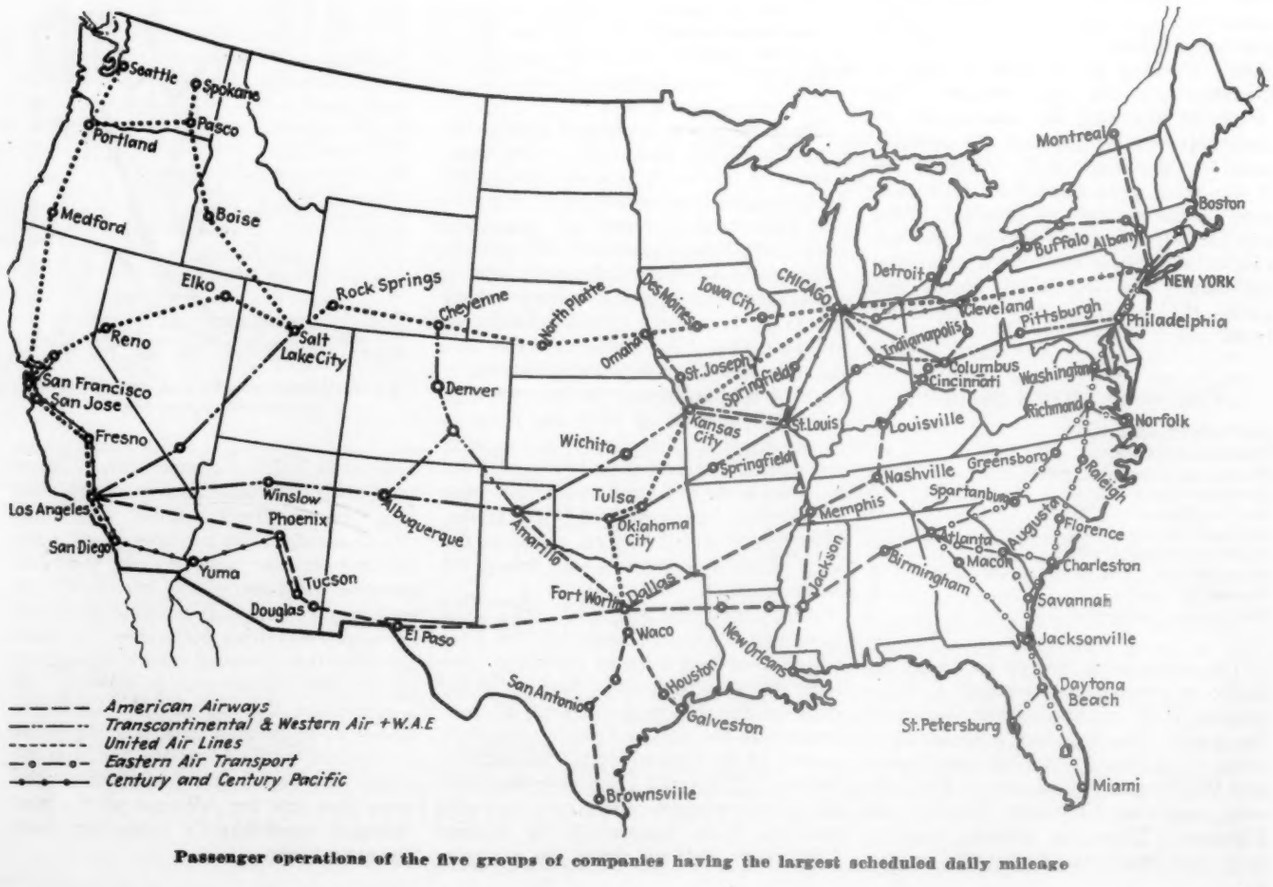


Air mail development and performance
(Discussion on page 108)

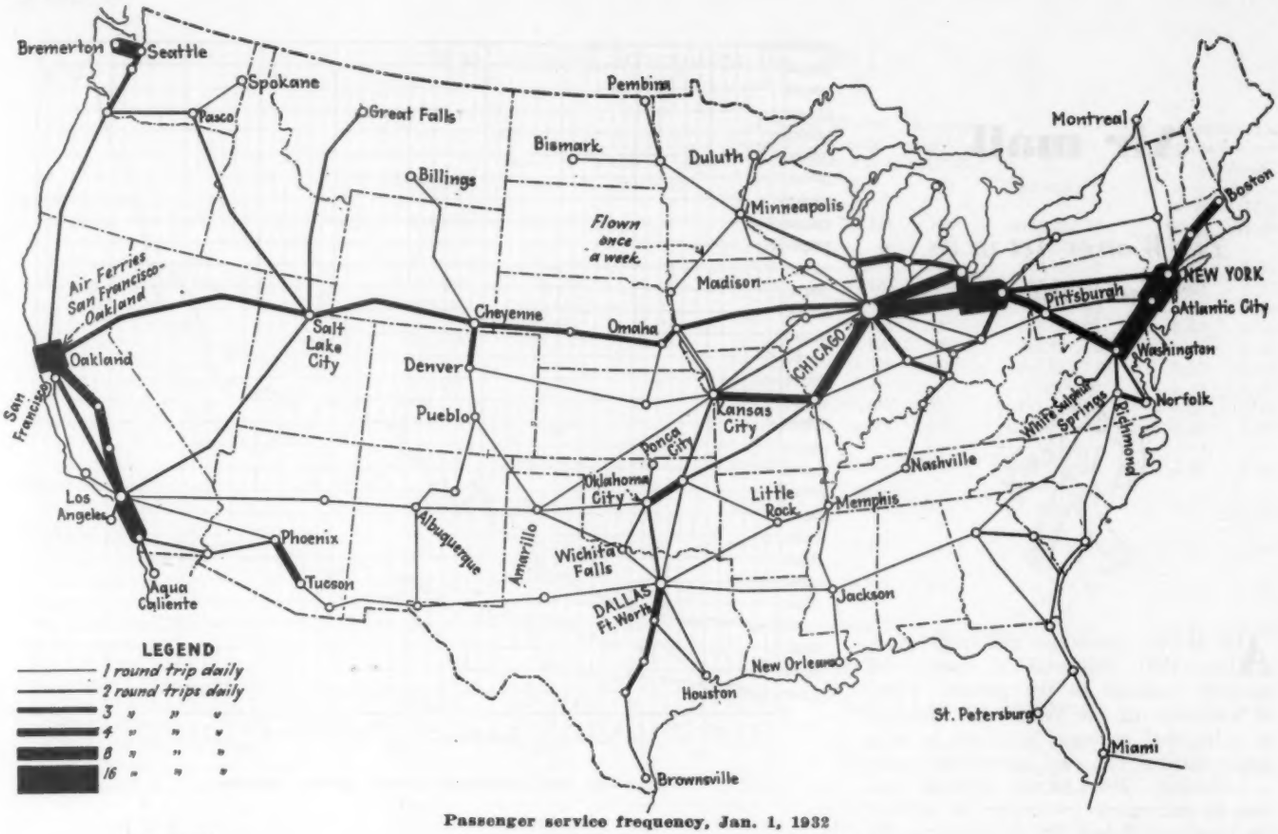
amount of indirect competition. There are only a few instances in which two lines run in direct parallel from one city to another, but in many cases, particularly in the eastern and southern parts of the country and on the transcontinental runs, it is possible to travel between two cities 600 miles or more apart by two or more routes not differing by over 20 per cent in mileage. It is sometimes the case that the total distances to be covered from starting point to terminal by the direct and the "roundabout" air routes are more nearly the same than are the mileages of the two railroads most directly competing over the same route.



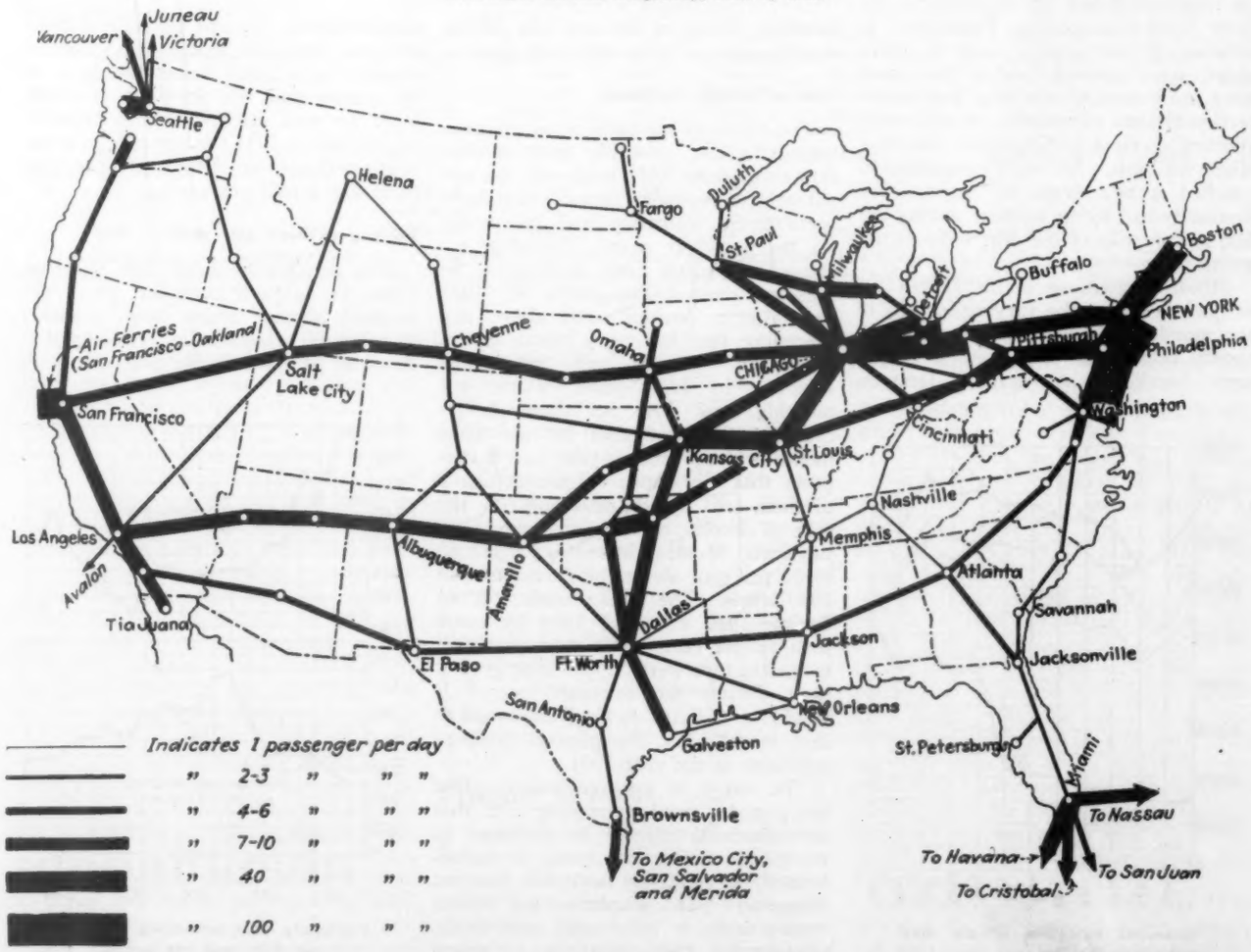
Air mail lines, frequency of service and ownership



Passenger operations of the five groups of companies having the largest scheduled daily mileage



Passenger service frequency, Jan. 1, 1932



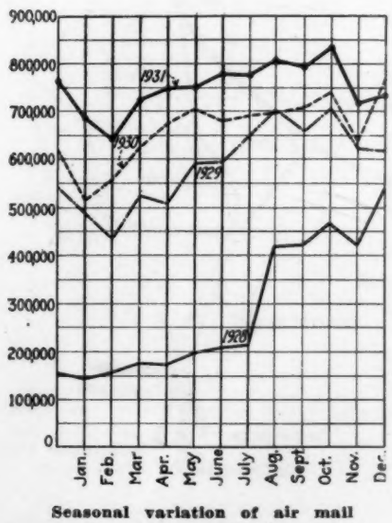
Average density of passenger traffic, first half of 1931 (Figures indicates total passengers daily, not passengers in each direction)

Air mail

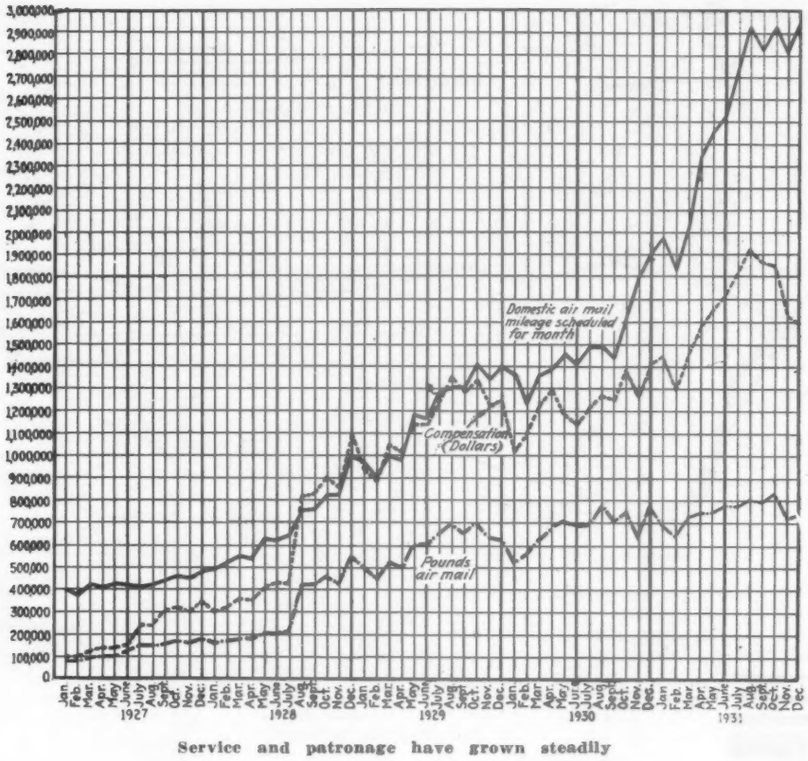
The Watres Act in its workings

AIR MAIL operations and traffic during 1931 followed a course in decided contrast to the general trend of business for the year. An increase in scheduled mileage as great as was made during the two preceding years is recorded. Most of the increase was due to increased frequency of service on long-established routes, such as the New York-Chicago-San Francisco. A number of new routes, most of them short, were opened. After the usual drop in February the rise was uninterrupted until the suspension of several summer services in September caused a slight set-back. Air mail compensation reached a new high in August, but unusually bad flying weather during the last two months of the year reduced the gains.

Minor fluctuations in the curves are frequently due to the varying lengths of the months. February is always a bad month because it starts with a 10 per cent handicap as against January.



Seasonal variation of air mail poundage (per month) since 1928



Service and patronage have grown steadily

October, fitting in between two 30-day months, always looks relatively good.

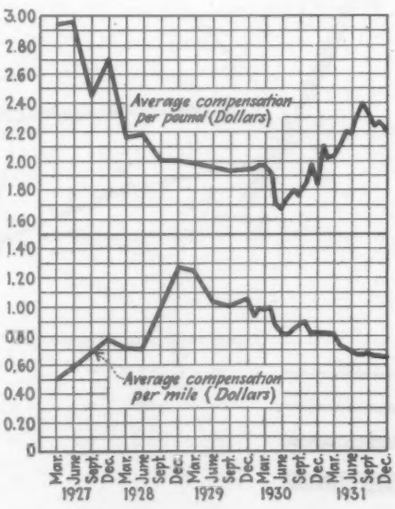
Rate of traffic increase

The curve of air mail poundage continued to rise smoothly at a modest rate throughout 1931 with only the apparently unavoidable drops which have occurred in February and November for the past four years. Poundage increases are much more evident in the seasonal chart. The curve for 1931 maintains a position well above any preceding year for every month except December. This is only the second instance in four years where the monthly total does not show an increase over the figures for the same month of the preceding year, and it suggests that Christmas shipments, many of them sent by air mail only for the sake of novelty, are playing a diminishing part. Monthly increases ranged up to 33 per cent above the corresponding 1930 levels. The total poundage flown during 1931 exceeded 1930 by more than 12 per cent, while total payments to contractors were 35 per cent greater than during the previous year. It would be difficult to find an equal to this increase in the general business activities of the year 1931.

The curve of average compensation per pound carried, competing with that for scheduled mileage in steepness of its climb during the year, is unfortunately of relatively negligible interest. Numerous new schedules and feeder routes carrying only small mail loads, account for the recent rise in pound compensation. Income per mile, a more adequate financial gauge, has dropped steadily to a point below the base of its phenomenal rise in June of 1928, when air mail rates were first reduced. At the end of 1931 the per-mile average is lower than at any time in the previous three and a half years.

Falling income per mile

The revision of rates that the Post Office Department made on Jan. 1 will produce another sharp drop, probably to below 60 cents a mile. Already it is down to barely half the peak figure of



Payments to contracting airlines, per mile and per pound

Mail carried by routes for 1931

	Scheduled	Actually flown	Per cent of scheduled mileage flown	Total weight of mail dispatched (pounds) 1931	1930	Average weight per scheduled trip	Amount paid to contractor	Average compensation per mile flown 1931	1930
American Airways									
1. Boston-New York	261,555	227,592	87.1	135,730	124,925	196	$154,244.69	$0.68	$1.24
1. Boston-Bangor[1]	21,012	14,671	69.8	1,382	.....	14	9,022.66	0.62	....
2. Chicago-Memphis	472,928	437,549	92.6	66,424	61,370	575	262,130.28	0.60	0.56
20. New York-Fort Worth[2]	1,251,182	1,121,233	89.6	208,091	143,822	266	698,825.06	0.62	0.41
21. Dallas-Galveston	244,945	233,233	95.1	37,263	36,410	51	139,799.03	0.60	0.48
22. Dallas-Brownsville	406,301	395,092	97.3	84,012	89,104	115	248,585.91	0.63	0.69
23. Atlanta-New Orleans	356,370	341,957	95.9	100,876	109,906	138	215,809.76	0.63	0.58
24. Chicago-Cincinnati	403,387	375,652	93.2	83,222	77,210	114	243,955.77	0.65	0.34
29. New Orleans-Houston	236,170	230,085	97.4	51,198	52,461	70	111,825.38	0.49	0.23
30. Omaha-Atlanta[3]	1,352,233	1,239,050	91.7	319,914	305,656	353	743,398.05	0.60	0.23
33. Atlanta-Los Angeles	2,019,786	1,888,829	93.6	240,380	46,347	329	1,645,928.71	0.82	0.90
Total	7,025,869	6,504,943	92.5	1,228,492	1,047,511	...	4,473,525.30	0.69	0.51
Eastern Air Transport									
19. New York-Miami[4]	3,489,848	3,244,999	92.8	938,657	649,999	469	1,974,404.89	0.61	1.02
National Parks Airways									
26. Great Falls-Salt Lake City	648,147	634,909	98.0	62,747	63,499	54	365,668.25	0.58	0.46
Northwest Airways									
9. Chicago-Pembina	1,478,431	1,422,430	96.2	276,091	225,133	286	912,557.50	0.64	0.66
Pennsylvania Air Lines									
11. Washington-Cleveland	466,044	388,804	83.5	91,111	65,012	94	171,151.36	0.44	0.90
Transamerican Airlines									
27. Bay City-Chicago	1,241,322	1,151,721	92.7	181,352	184,774	296	612,711.65	0.53	0.48
Transcontinental & Western Air									
34. New York-Los Angeles	3,426,668	3,073,728	89.6	587,624	48,652	573	1,810,894.68	0.59	0.39
Western Air Express									
4. Salt Lake City-San Diego	1,042,679	1,028,007	98.5	638,616	856,757	875	930,486.97	0.90	1.71
12. Cheyenne-Albuquerque-Amarillo	353,174	339,507	96.3	107,209	89,399	147	201,625.37	0.59	0.57
33. Albuquerque-El Paso[5]	67,200	66,096	98.3	3,123	.....	103	52,269.09	0.79	....
Total	1,463,053	1,433,610	98.0	748,948	946,156	...	1,184,381.43	0.83	1.56
United Air Lines									
3. Chicago-Dallas	1,856,326	1,673,011	90.3	511,452	439,050	350	1,193,209.40	0.71	0.91
5. Salt Lake City-Seattle	1,283,230	1,217,227	95.0	347,082	395,717	475	951,541.48	0.78	0.93
8. Seattle-San Diego	1,386,172	1,340,103	96.8	400,715	289,045	365	891,102.09	0.67	0.88
17. New York-Chicago	2,087,185	1,813,590	87.0	1,709,810	1,693,964	668	1,483,056.51	0.82	1.08
18. Chicago-San Francisco	4,204,365	4,088,665	97.5	1,807,535	1,955,145	900	3,747,952.83	0.92	1.41
Total	10,817,278	10,132,596	93.5	4,776,594	4,688,893	...	8,266,862.31	0.82	1.13
United States Airways									
30. Kansas City-Denver[6]	200,192	188,568	94.5	12,885	.....	35	75,427.20	0.40	....
Total	30,285,139	28,205,943	93.1	9,005,079	8,003,653	...	$19,860,050.54	0.70	0.88

[1] Inaugurated Aug. 1, discontinued Sept. 30. [2] Includes route 16 from Cleveland to Louisville, with which it consolidated June 1. [3] Includes route 28 from St. Louis to Omaha, with which it consolidated May 15. [4] Includes route 25 from Atlanta to Miami, with which it consolidated April 1. [5] Inaugurated Aug. 1. [6] Inaugurated June 5.

the winter of 1929-30, and a third lower than at the time when the Watres Act was passed to put the air mail business on a sounder footing. The average income to the mail contractors, per mile flown, was 17 per cent lower in 1930 than in 1929, and 20 per cent lower in 1931 than in 1930. It seems likely that there will be a further drop of around 15 per cent in 1932. An extraordinarily high rate of increase of operating efficiency is required to keep up with any such rate of fall of income as that.

When compared with 1930 figures, the average weights per scheduled trip at first glance show little progress, for less than 100 lb. of mail were averaged on each trip by six routes. Since, however, one of these was a branch maintained largely as a passenger service for two months during the summer, and another is a feeder route of only six months existence, the 1931 score is virtually four routes as compared with the 1930 total of six. These four routes were also in the low poundage group in 1930. The other two routes passed the 100 lb. mark during 1931, one with an average of 575 lb. of mail each trip.

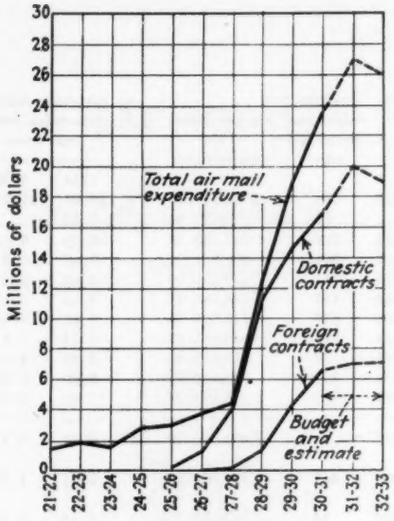
The routes having the highest average mail loads in most cases show a drop from their figures of the two previous years. The Boeing line, for example, has averaged only 900 lb. per trip in 1931 as against 1,355 in 1929, although the total weight of mail handled has increased. The reason, in that case and in others, is of course the increased frequency of schedule made possible by the mingling of passenger and mail loads. Very high mail loads are not as important now as when there were no passengers to help fill the ships.

Divisions of traffic

COMPARISONS of traffic and compensation on individual mail routes between 1930 and 1931 are complicated by the numerous extensions and consolidations. However, an equable basis for comparison has been achieved by totalling the 1930 figures for the two routes which became one during the past year, as for instance the New York-Atlanta and Atlanta-Miami routes which now are covered by Route 19.

The Watres Act, which had already begun to show its effect in 1930, together with extensive consolidations in the operation of the routes, is responsible for the changes observable, the most striking of which is a definitely increased uniformity of compensation. While in 1930, $1.80 was remarkable as the highest average compensation received, for the year just ended only two contractors averaged half that sum per mile flown. On the other hand, the bottom price received by any route during 1931 was 40 cents, and only two other routes averaged less than 50 cents a mile, while the 1930 low was 23 cents, averaged on two routes, with six others receiving less than half a dollar per mile flown.

Increases in mail poundage over 1930 are due in the case of many routes, notably New York-Fort Worth, New York-Miami and Washington-Cleve-



The air mail and the federal budget

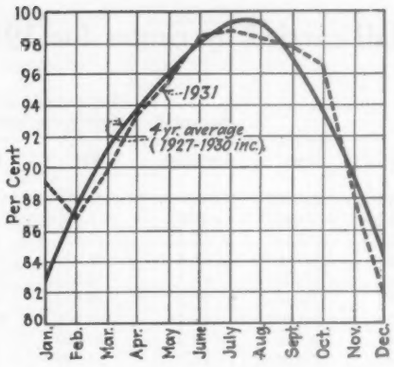
land, to extensions of route and consolidation with others resulting in a great increase in territory served. However, large traffic increases are observable in routes such as the Chicago-Dallas, Boston-New York, and Seattle-San Diego, substantially the same during the past two years, while only eight routes showed any decrease. These were of more than 12 per cent in the single instance of the Salt Lake-San Diego route, which felt heavily the competition of the two new transcontinental runs established late in 1930. That the drop should not be laid to any decline in West Coast interest in air transport is evidenced by the record of the Seattle-San Diego route, which in 1931 carried 38 per cent more mail than it carried during the preceding year.

The four largest operators accounted in the aggregate for 87 per cent of the mail poundage flown, but received only 83 per cent of the total compensation. Their average pay per pound was only three-quarters of the average for the five smaller companies holding mail contracts.

Regularity of service

(See also chart at top of page 103)

Regularity of air mail service, as indicated by the ratio of mileage flown to mileage scheduled, shows little change from 1930 figures. Slightly better than for any year since 1925, the current ratio is still below the level at which it was maintained when the air mail was under government operation and when there was little or no night flying. Consideration for passenger comfort and safety on the increasingly large number of routes not limited to mail service helps to account for this condition, yet it is surprising that all the work done on blind flying in the last few years has not yet shown more definite effect on the reliability



The regularity varies with the seasons (percentage of scheduled mileage actually flown)

figures. More favorable flying weather and topography serve to promote higher percentages of regularity in some parts of the country than in others. However, the Great Falls-Salt Lake City and Chicago-Pembina routes, to mention two passenger-mail routes which are handicapped by average weather conditions and terrain, achieved records of regularity of over 96 per cent, rivalling those of the days of government operation. Also, nine out of thirteen routes scoring over 95 per cent regularity carried passengers as well as mail.

Accident rates

IN SPITE of two very dramatic transport line accidents, in each of which a number of lives were lost, the safety record of American aviation was better in 1931 than in any preceding year.

There has been a great deal of argument about the best way of presenting accident statistics. Sometimes they are given in fatalities for airplane miles flown, which is absurd, since it counts a twenty-passenger machine and a five-passenger machine as equal. Another commonly used method is to give accidents in terms of numbers of passengers flown, which is better, but still not good, for it assumes that the hazard of a transcontinental trip is no greater than that of one across Puget Sound. The only really reasonable figure for passenger hazard is the number of fatalities per 1,000,000 passenger-miles. That is the

Transport accident record

Pilot fatalities per million miles flown

1918	9.75	1926	0.88
1919	8.67	1927	1.24
1920	7.62	1928	0.84
1921	3.66	1929	1.14
1922	0.57	1930	0.27
1923	2.65	1931	0.27
1924	1.38	Average, 1922-1926	1.08
1925	0.40	Average, 1927-1931	0.44

Passenger fatalities per million passenger-miles

1927	0.59	1930	0.24
1928	0.85	1931	0.22
1929	0.28	Average, 1928-1931	0.29

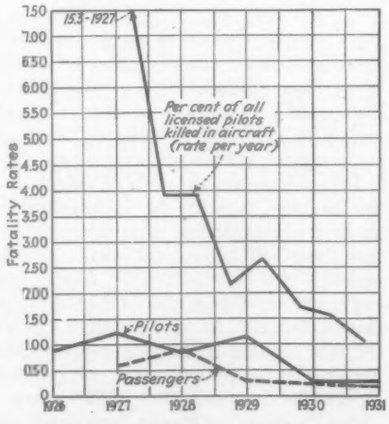
one figure that tells the traveler by air how small are his chances of being killed or injured in a million miles or any other given amount of flying. On that basis the passenger death rate on transport lines in 1931 was 10 per cent lower than in any previous year. As will be noted from the table on page 138, the American accident record in recent years is distinctly better than that of any European country except the Netherlands.

Improving pilot safety records

Pilot hazards have been studied from two points of view. First, the death rate among transport pilots has been expressed in terms of millions of miles flown. The pilot rate just about equals the best record of any previous year. In the last two years there has been surprisingly little difference between the fatility rates for passengers and for pilots, considering that the pilot figure includes a large amount of mail flying, at night or in bad weather, where no passengers are carried because it is considered too dangerous.

The second system of rating pilot hazards is the one favored by the insurance companies. It calls for the determination of a straight death-rate, or per cent of exposed personnel killed per year. That curve of course includes all pilots, private and professional, not merely those of transport lines. It, too, shows a notable improvement. The general safety of flying for the whole body of pilots shows an increase of 50 per cent over the best previous record, and about 280 per cent over 1928. Even if allowance be made for about 5,000 pilots who do not fly civil aircraft with any frequency, the average death-rate among those actively engaged in civil flying is only about 1.5 per cent.

It is believed that the general practice of life insurance companies in imposing additional loadings on the premiums for policy holders engaged in aviation is based on an assumption of a considerably higher special aviation hazard than these figures show to exist.



Pilot and passenger fatalities per million person-miles, and accident death rate among pilots

Airports and airways

How many miles to the nearest field—and what's being done there?

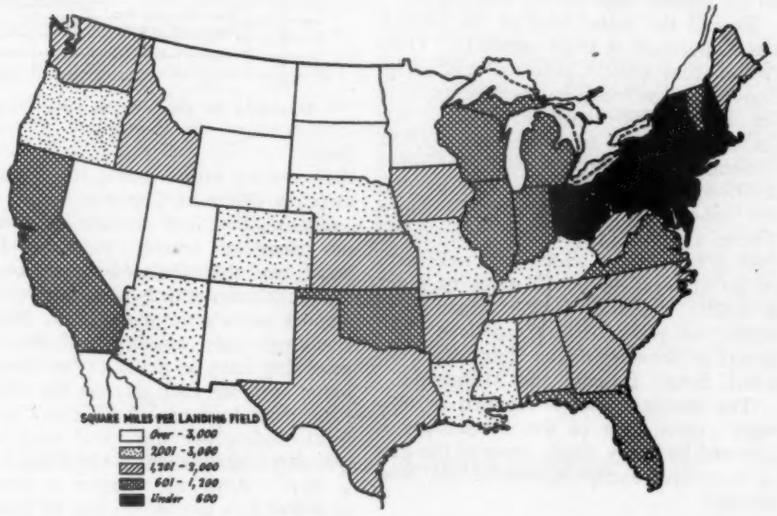
AIRPORT construction has continued with astonishing regularity. For five years the total number of commercial and municipal fields has been increasing at an almost constant rate of 200 per year. Furthermore, the two classes continue to gain ground at about the same rate. After the effects of the 1928 spurt in municipal airport construction, largely due to the Lindbergh tour, had subsided, the commercial fields slipped into the lead. They still keep it, although always by a very small margin. It is encouraging to find that in spite of hard times, and of unfavorable financial reports from many of the existing ports, capital can still be found to open new ones in favorable locations.

At the same time it has become evident from a survey conducted by AVIATION, and reported on page 113, that a considerable number of these fields listed by the Department of Commerce are in fact virtually inactive. For the country as a whole, it is probable that about 15 per cent of the airports are that only in name. Some of them no longer present even a landing surface, while many others are only auxiliary fields with no permanent facilities for storage or servicing. The number of ports in really fit condition probably is somewhere around 1,100.

The intermediate fields of the Department of Commerce and the marked auxiliary fields have both shown good increases during the past year, the latter reversing a long-continued downward trend.

Airport density

The map which is presented herewith, showing the geographical distribution of American airports, shows a more or less satisfactory situation in the north-



Status of airports and landing fields by states, Jan. 1, 1932

	Municipal	Commercial	Intermediate	Auxiliary	Army	Navy	Miscellaneous†	Totals	Square Miles per field*
Alabama	6	4	9	7	3	..	..	29	1,770
Arizona	23	7	13	7	1	..	..	51	2,230
Arkansas	13	5	4	6	..	..	..	28	1,880
California	59	62	27	23	3	1	..	175	890
Colorado	17	8	5	7	1	..	..	38	2,730
Connecticut	6	10	1	2	..	..	..	19	254
Delaware	..	2	..	..	1	..	1	4	491
Dist. of Col.	..	1	..	..	1	1	..	3	20
Florida	28	15	4	11	..	2	..	60	914
Georgia	17	2	19	1	1	..	..	40	1,470
Idaho	21	1	10	12	..	..	2	46	1,810
Illinois	14	47	12	5	2	1	..	81	694
Indiana	8	19	14	1	1	..	..	43	839
Iowa	10	16	11	3	..	..	..	40	1,390
Kansas	23	20	6	5	2	..	..	56	1,460
Kentucky	5	8	7	..	..	..	..	20	2,005
Louisiana	10	6	2	4	..	..	..	22	2,060
Maine	2	9	..	5	..	..	1	17	1,760
Maryland	2	11	3	3	3	..	1	23	430
Massachusetts	4	27	2	6	..	1	1	41	164
Michigan	35	29	2	7	2	..	1	76	755
Minnesota	14	8	2	1	1	..	..	26	3,110
Mississippi	10	1	4	3	..	..	..	18	2,575
Missouri	6	10	11	3	..	..	..	30	2,290
Montana	15	4	9	6	..	..	..	34	4,300
Nebraska	11	5	13	..	1	..	..	30	2,560
Nevada	7	2	13	2	..	1	..	25	4,390
New Hampshire	7	4	..	6	..	..	..	17	531
New Jersey	5	18	1	2	1	1	..	28	269
New Mexico	9	5	10	8	1	..	..	33	3,710
New York	16	54	9	7	3	..	1	90	530
North Carolina	12	10	9	5	1	..	..	37	1,319
North Dakota	12	4	..	..	..	..	..	16	4,380
Ohio	13	40	18	8	4	..	1	84	481
Oklahoma	24	15	9	10	1	..	..	59	1,175
Oregon	17	6	19	5	..	..	..	47	2,030
Pennsylvania	6	67	18	7	3	1	1	103	435
Rhode Island	..	8	..	1	..	..	2	11	97
South Carolina	8	4	3	..	..	1	..	16	1,905
South Dakota	7	13	..	2	..	..	..	22	3,490
Tennessee	9	5	8	5	..	..	..	27	1,545
Texas	52	13	43	21	12	..	..	141	1,865
Utah	3	..	19	..	..	..	..	22	3,730
Vermont	3	7	..	1	1	..	1	13	702
Virginia	10	8	10	4	1	2	..	35	1,150
Washington	17	13	6	2	3	1	..	42	1,590
West Virginia	2	7	..	3	..	..	..	12	2,000
Wisconsin	22	29	7	8	..	..	..	66	838
Wyoming	11	2	12	3	..	..	..	28	3,480
Totals	631	671	404	238	54	13	13	2,024	1,470

†Government, state, and private. *Based on land area.

eastern part of the country. Naturally, airports are closest together where the largest number of centers of dense population exist, and where topography or culture or conditions of land ownership make natural landing fields few and far between. New England and the Middle Atlantic states satisfy both conditions, and there is a solid block of states, including everything north of Washington and the Ohio River except Vermont and Maine, that have at least one port for every 600 sq.mi. of area. No other state fulfills that condition, which is as a matter of fact a very modest one. To provide reasonable safety in bad weather flying for the itinerant pilot, or in the event of forced landing, there certainly should be at least one landing field every 25 miles in every direction. To attain that position we must have at least one field for every 500 sq.mi. of area. Only ten states have so far closely approached that figure.

Few of the states west of the Mississippi approach it even remotely. Only two in that area, California and Oklahoma, have as much as one landing field for every 1,200 sq.mi. of area. Only six have as much as one for every 2,000, although to have only one field for every 2,000 sq.mi. means on the average that the nearest airport is 20 miles away. There are sure to be some points, in such a case, from which it is necessary to go at least 40 or 50 miles to reach a field. Yet that is the situation of states as populous and as free from desert or dense forest as Nebraska, Missouri, South Dakota, and Minnesota.

The standard that is reached by only eight states west of the Mississippi is attained by every single state to the east of that river except Kentucky and Mississippi.

Activities and improvements

BY COURTESY of the Aeronautical Chamber of Commerce, we have been able to examine the originals of the quarterly questionnaires submitted to the Chamber, and to tabulate the data that they contain. Only a relatively small number of airports furnished reports, an average of 85 in each quarter, but they include a good proportion of the most important fields and certainly they average a larger amount of activity than do the entire group of American airports, taken as a whole.

Taking that into account, the amount of operation shown is astoundingly small, and the tabulated figures confirm the conclusions drawn from our own airport survey on page 113. Roughly speaking, only one-third of the fields reporting have as many as one transient plane arriving each day on the average. Less than half report as many as five local flights per day, and only about two-thirds sell as many as 10 gal. of gas a day. With so meager a level of activity, it is not surprising to find that only about a quarter claim to be making an operating profit.

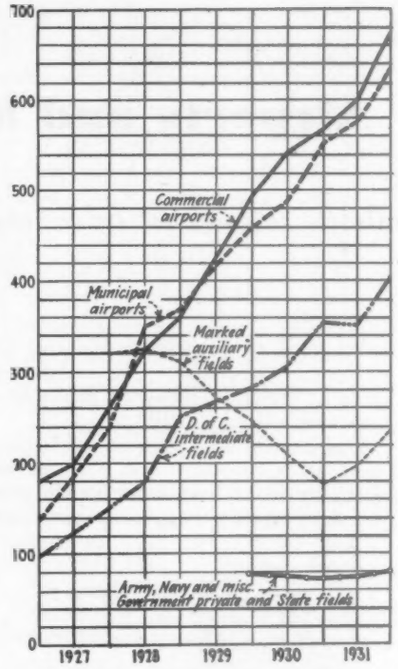
The total number of transient departures reported for the year shows an average of a little less than two per day per port, some fields of course running up to ten or more. If it be assumed that the fields reporting represent 10 per cent of all American airport activity, which appears to be a fair estimate, the total number of cross-country flights during the year can be worked out at about 570,000. If 8,500 planes be in operation, and on page 121 we conclude that that is the most probable figure, they must then be averaging about 70 cross-country flights each per year—not an unreasonable figure, although a little higher than we would have been inclined to expect. Applying the same system of calculation to local flights gives an estimate of 600 per airplane per year. When read in conjunction with the analysis on page 114 that figure seems high, but if we take account of the machines regularly used in teaching, and making several hundred short flights each month, it appears quite reasonable.

Though the average number of ports that can be considered as reporting for the year as a whole is only 85, 150 furnished some information on their current status for at least one-quarter, and an encouragingly large number of them

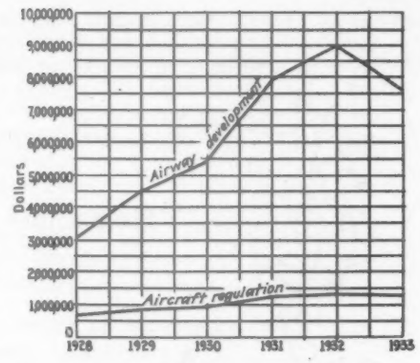
Airport summary

Total number of airports from which reports were drawn	150
Average number reporting each quarter	85
Average number reporting at least one transient plane departure daily	28
Average number having at least five sightseeing and miscellaneous flights daily	36
Average number selling at lest 10 gal. of gasoline daily	53
Average number showing a profit	21
Total number of transient plane departures in 1931	57,086
Total number of sightseeing and miscellaneous fixed base take-offs in 1931	502,148

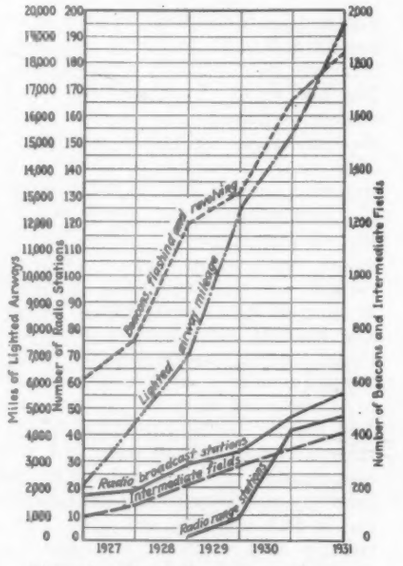
Based on surveys by the Aeronautical Chamber of Commerce.



Numbers of airports in operation, by classes.



Department of Commerce appropriations—fiscal years.

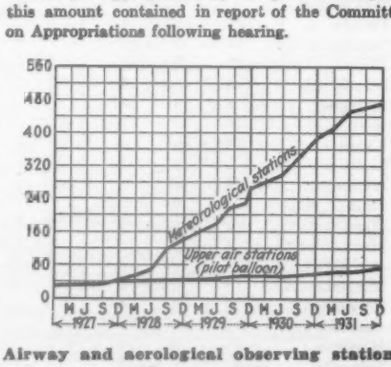


Department of Commerce airway development.
(See page 111)

Special appropriations for weather service on civil airways

Fiscal year ending June 30		Fiscal year ending June 30	
1927	$75,000	1930	$710,080
1928	120,000	1931	1,272,660
1929	243,500	1932	1,709,340
		1933	*1,457,440

*Not yet appropriated by the present Congress; this amount contained in report of the Committee on Appropriations following hearing.



Airway and aerological observing stations.
(See page 111)

were engaged in development work of some kind. Forty-three were increasing the area of the landing field, 25 were adding runways, 50 were adding lighting equipment or improving what they already had, and 44 were increasing their hangar space. Although the ports that are engaged in such work are much more likely to make report than those that are not, it is fair to estimate from these figures that at least one-fifth, and perhaps a quarter, of the active airports have undertaken some improvement of their facilities in 1931.

Servicing

A COMPARATIVE survey of servicing operations of the last three years has been attempted, but so few operators were able to furnish figures in comparable form for the entire period that the results were somewhat unsatisfactory. The general indication is that the amount of servicing work increased by some 50 to 80 per cent in 1930 over 1929, and in 1931 dropped back about 10 to 20 per cent. As would be expected in view of the effort to keep old planes operating, servicing has perhaps held up better than any other type of aeronautical activity except air transport. The aggregate gross income for servicing work in 1931 (not including work done by operating companies on their own machines) may be estimated, quite roughly, at $3,500,000.

Airway development

AIRWAY development has gone on normally during the past year. Almost half the total mail route mileage is now lighted. The installation of radio broadcast stations is also progressing at a normal rate of about ten each year. There is now one for every 75,000 sq.mi. of the United States, which permits of their being spaced 300 miles apart on the average in all directions. Radio beacon work slowed down in 1931, after having been sharply accelerated in the previous year. The number of range stations will still have to be increased by 400 per cent to take care of all American airways.

In lighting work the tendency to increase the spacing of the beacons continues. In 1927 there was a beacon operating for every three and a half miles of airway. At the end of 1931 the average distance is 11 miles, an increase of 2 miles in the last year. In the last two years beacons have been added at the rate of only one for every 13 miles of newly-lighted airway.

The Budget estimates for 1933 show the first decreases that have ever been made in the amounts allowed for airway development and for aircraft regulation. The change in the allowance for regulation, which has been practically stabilized at $1,300,000 a year for the last two years, is small. The cut from airway development, which takes almost seven times as much money as the Department's regulatory work, is more drastic.

Weather bureau

ALTHOUGH the number of airway meteorological stations has continued its increase in 1931 with almost as high a rate as in the two years preceding, the present allotment of funds for airway meteorological work does not permit of anything like complete coverage of the problem. There is still only one meteorological station for every 7,000 sq.mi. of the continental United States, or about one every 90 miles in all directions. Considering only the established transport routes, there is approximately only one station for every 90 miles of airways. The 13 per cent cut in the new budget, as compared with the 1932 appropriation, will make any increase of facilities in the next eighteen months extremely difficult.

●

The National Advisory Committee for Aeronautics

ALTHOUGH demands on the National Advisory Committee for services and publications continue to increase, the Budget estimate for the coming year shows a drop. Only once before in the last ten years has the amount available for the Committee's general work, excluding new buildings, been reduced below the previous year's figure.

During 1931 the staff at Langley Field continued its growth, unbroken since the laboratories were founded. The increase of staff, however, has been considerably less than the increase in the amount of work completed for distribution to the aeronautical industry.

Although, of course, too much stress must not be laid on the number of the reports published, since they vary greatly in the amount of work required and in their individual value, it is of interest to note that the total number of publications from the Committee's laboratory was 60 per cent larger in 1931 than in any previous year. In spite of depression, the public demand for the publications has increased rapidly, and only by careful limitation and pruning of the mailing list was the number of copies distributed kept within its present limits.

Appropriations and personnel of N.A.C.A.

Fiscal year	Total appropriations	Employees at Langley Field Laboratories
1923	$225,600	53
1924	307,000	77
1925	470,000	107
1926	534,000	121
1927	513,000	141
1928	550,000	156
1929	628,770	177
1930	*1,508,000	197
1931	*1,321,000	236
1932	1,050,070	270
1933	1,012,310[1]	...

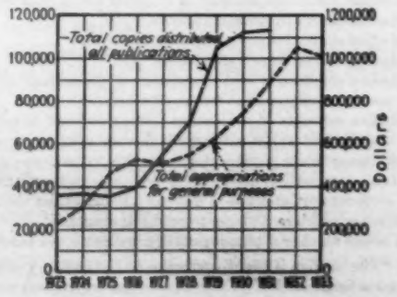
*Material increase includes $763,000 in 1930 and $435,000 in 1931 for construction of full scale wind tunnel, seaplane channel, and heating plant. Amounts available for general purposes, $745,000 for 1930 and $886,000 for 1931.

[1]Tentative only.

Publications of the N.A.C.A.

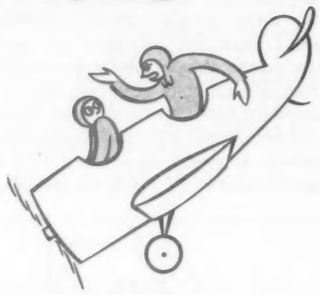
	Technical reports	Technical notes	Technical memorandums	Aircraft circulars	Total Copies distributed
1923	21	51	67	..	36,870
1924	23	37	52	..	37,209
1925	22	19	49	..	35,884
1926	27	24	47	26	39,207
1927	28	17	52	38	55,636
1928	20	30	50	23	70,663
1929	35	28	52	19	104,076
1930	32	30	54	25	112,010
1931	39	44	55	25	112,687

	Technical Reports		Technical Notes	
	Originating with N.A.C.A.	All other sources	Originating with N.A.C.A.	All other sources
1923	8	13	11	40
1924	10	13	15	22
1925	8	14	12	7
1926	14	13	19	5
1927	17	11	10	7
1928	15	5	20	10
1929	20	15	19	9
1930	17	15	19	11
1931	27	12	35	9



Schools, services, and miscellaneous flying

How much flying? And what kind?



THE 1931 survey of flying school activities has been limited to the Class A group, including only the Department of Commerce approved schools and a few outstanding schools which do not have that rating. Of the 28 approved schools, 21 furnished data for AVIATION. Returns from a total of 35 schools are included in the survey.

Prominent features of the 1931 reports are the continued downward trend in the tuition fees and in the number of students enrolling. Other figures closely approximate those for 1930. Most of the students still aim to secure employment as professional pilots, but the proportion reported as planning to buy private machines is nearly double that in 1929 or 1930, which is a good sign. About 15 per cent of all students are reported to be learning to fly merely as a general accomplishment, without any idea of making any immediate use of it,—a class quite negligible in previous years.

The reaction of the schools to use of the very light type of plane for student instruction is illuminating. Including a number of Curtiss-Wright units, 26 schools used them in dual instruction and had good results. One reported a strong negative reaction to the type. Another used a light machine merely as an inexpensive medium for accumulating air time, not for instruction.

The number of new students enrolled during the year was less than half of the number for the year before. Instructors per school dropped from an average of 2.1 to 1.7, and the instructors' load increased. Each one had to handle an average of 25.3 students during 1931, as compared with 21 in 1931 and but 14 in 1929. Student permits dropped again, from 18,000 to about 16,000. If the schools reporting may be taken as representing about 40 per cent of all flying school activity, which is probably a fair estimate (see discussion on page 113), only about 25 per cent of those receiving permits reached the stage of taking formal flying instruction. For the two previous years it is estimated that about 50 per cent entered schools of some sort. Obviously, the man who takes a student permit merely so that he can legally handle a dual control on occasion, and who keeps his student permit alive from year to year without ever having any idea of entering a school or qualifying for a pilot's license, is becoming an increasing factor in the situation.

Tuition fees much lower

The tuition fees dropped for each type, of course. They are off, on the average, about 20 per cent from a year ago. The rate of decrease during 1931 averaged about double that during 1930. Despite the lowered fees the total student enrollment reported dropped more than 50 per cent from 1930.

It is surprising, in view of almost universal price-cutting by the schools, that there was no increase in the practice of allowing instruction on a pay-as-you-go basis. Also, there is a distinct drop in the number of schools renting planes to graduate students wishing merely to accumulate time. A year ago practically all of the schools reported that they rented machines to graduates, but this year only 25 per cent are doing it.

A conservative estimate places the gross income of the 35 schools at about $1,211,000. If we consider these schools as about 40 per cent of the total, allowing for the fact that the average school in the remaining 60 per cent charges lower tuition fees than those represented in our survey, the total income for flying schools for the year was about $2,500,000.

Tabulation of flying school questionnaire answers

	1929	1930	1931
Total number of schools reporting	13	36	35
Number of schools having operated at least since 1925	6	3	2
Average number of flying instructors per school	3.5	2.1	1.7
Average number of ground instructors per school	4.6	3	2.8
Average number of graduates per school since starting operations	225	142.9	99.7
Average number of graduates from transport course	2.5	5.9	6.0
Average number of graduates from limited commercial course	13.0	22.4	20.0
Average number of graduates from private course	23.0	28.1	27.2
Total number of students enrolled	1,130	3,553	1,546
Average number enrolled per school	87	98.6	46.6
Average maximum number of students under instruction at any one time	55	50.6	36.3
Median charge for transport course*	$4,100.00	$3,837.50	$3,250.00
Median charge for limited commercial course*	$1,300.00	$1,197.50	$922.50
Median charge for private course*	$550.00	$475.00	$375.00
Median estimate of school operators of percentage of students planning to secure employment as transport pilots	55	65	55
Median estimate of percentage looking forward to employment in the aircraft industry, but with only incidental piloting	20	15	15
Median estimate of percentage planning to purchase private airplanes	10	8.5	15
Median estimate of percentage learning to fly simply as an accomplishment, without any intention of putting it to direct and regular use	....	....	15
Number which rent planes to graduate students	....	34	9
Average number of planes used in instruction, per school	....	....	7.4

*The median is slightly superior to the ordinary arithmetical average as a means of showing the trend in such a figure as this. Those of our read ers who are not familiar with the term and its use can consider it as being the average charge, from which it would differ only slightly.

Operations survey

IN PREPARING a general survey of flying activity in the United States and of the purposes for which airplanes are being used, we have had two primary sources. Every owner of aircraft is required to submit a semi-annual operations report to the Department of Commerce, and many of our conclusions are drawn from those reports. We have supplemented them with a general questionnaire on operations to all the airports in the United States, which furnished the material for the large table on the opposite page.

The department's figures provided the data for the smaller table in this department and the "pie chart" that accompanies it. Almost all the figures in that survey are put upon a percentage basis, as lack of time prevented a complete examination of the records. The proportions are based on a study of the operating reports on about 600 planes

located in the northeastern United States. With minor exceptions, however, the conclusions drawn from that group would apply with satisfactory accuracy to the country as a whole.

The most striking fact that emerges from all this work is the concentration of most of the flying activity at a few airports, in the hands of a few companies, and actually in a relatively few airplanes. Of the airports responding to our questionnaire, about half of all those in the country, 17 per cent reported themselves wholly inactive and 23 per cent had no commercial flying. If a 100 per cent return could have been secured the proportion of inactivity would probably have been still larger. Almost all of the large and well-known fields made response, but there is but little incentive for the manager of a wholly inactive field to take the trouble to announce its torpor or indeed to respond to any correspondence.

Many airports inactive

The presence of five commercial planes does not make an airport a very busy place. Yet only 30 per cent of the fields reporting showed as much activity as that, and in six states there were none in the five-plane group. Only 7 per cent had as many as a dozen planes in commercial operation.

Pursuing the question of concentration further, it develops that 53 per cent of the fixed-base operators on whom report was received have but one plane. That is in approximate accord with the figure derived from the Department of Commerce data. Only 14 per cent of all the operators have more than four ships. Roughly speaking, 25 per cent of the airports show two-thirds of the activity, and 20 per cent of the operators have over half the planes in service. The whole country, allowing for the areas from which no information was received in the present investigation, shows only about 200 fixed-base operators with as many as five ships.

No very striking geographical differences appear on these points, except that California, with more airports than any other state in the Union, has an unusually large proportion of them inactive or with very little activity, while New York has an unusually small, and Illinois an unusually large, proportion of very large fixed-base operators.

Large firms do most flying

The figures from the Department of Commerce files give similar indications on concentration. It must be remembered that they cover only 583 planes, about 100 of them engaged in transport work. Seventy-five per cent of the whole amount of business flying for the group was done by ten owners, 36 per cent of it by two oil companies. The figures on flying schools are still more extreme. Reports were studied for 74 operators engaged, according to their own reports, in giving flying instruction. Only four of them ran approved schools, and those four did three-quarters as much flying as the other 70 combined. Taking the 74 "schools" altogether, two of them did more than 40 per cent of the total amount of flying. The ten largest schools did more than 70 per cent of all the instructional flying, dual and solo. Fifty of the 74 had but one plane each, and were averaging less than 30 hours of flying a year.

Of the planes on which individual reports were examined, probably representing a very fair cross-section of the country, only 2 per cent were used during the first half of 1931 at the rate

Fixed base operations

	Airports					Flying Services			Number of flying services engaged in								
	Total number reporting	Wholly inactive	Number operating commercially			Total number reporting	Number operating		Total number of planes	Sale of planes	Servicing	Instruction	Taxi	"Hop flying"	Photography	Dusting	Advertising	Exhibition
			One or more planes	Five or more planes	Twelve or more planes		Two or more planes	Five or more planes										
Alaska	3	0	3	2	0	4	3	1	17	3	3	0	4	3	0	0	0	0
Alabama	5	1	3	2	0	7	4	1	15	3	3	5	7	6	1	0	3	2
Arizona	10	3	5	3	0	10	3	2	25	4	5	9	9	9	2	1	3	3
Arkansas	10	1	8	1	0	14	7	2	32	8	3	15	9	12	4	1	1	5
California	58	18	37	17	8	128	63	16	345	55	50	87	81	87	39	8	22	25
Colorado	16	6	9	1	0	16	3	0	21	7	5	10	14	13	2	0	5	6
Connecticut	7	0	7	1	1	10	9	1	31	5	8	8	6	8	6	0	1	2
Delaware	1	0	1	1	0	1	1	1	5	1	1	1	1	1	1	0	1	1
Florida	15	3	12	2	0	23	8	1	39	11	10	17	13	20	8	0	7	4
Georgia	5	1	3	1	0	7	4	1	16	2	4	7	5	7	3	0	1	0
Idaho	4	1	3	0	0	4	2	0	8	3	4	3	3	4	1	0	1	2
Illinois	32	0	31	13	1	60	26	13	172	30	35	36	47	51	19	3	20	16
Indiana	16	1	15	4	0	24	13	1	52	16	13	20	14	22	10	0	7	5
Iowa	16	6	10	2	0	16	8	1	38	11	10	9	13	16	5	0	4	3
Kansas	16	5	8	3	1	14	4	2	39	5	9	8	7	11	2	0	1	1
Kentucky	1	0	1	1	0	1	1	1	8	1	1	1	1	1	1	0	1	1
Louisiana	5	0	5	1	1	10	2	1	29	5	5	4	3	6	4	1	6	1
Maine	4	0	4	1	0	8	3	1	14	4	2	6	4	7	2	0	1	3
Maryland	4	0	3	3	1	6	4	1	30	4	4	3	5	5	2	1	2	2
Massachusetts	16	0	16	7	3	31	22	6	124	18	17	18	24	28	10	0	2	3
Michigan	22	3	18	7	2	54	19	5	117	22	17	27	38	36	10	0	10	9
Minnesota	8	1	7	1	1	30	7	0	24	16	4	27	25	28	13	0	0	4
Mississippi	5	1	3	0	0	4	2	0	6	3	3	4	4	3	1	0	3	0
Missouri	10	1	8	5	3	45	15	7	106	14	12	24	33	32	8	0	19	7
Montana	11	2	8	2	0	15	8	0	25	4	5	10	10	12	1	0	1	2
Nebraska	8	1	7	4	2	15	12	3	48	10	5	11	10	10	6	5	6	2
Nevada	4	2	2	1	0	4	1	1	7	1	1	3	3	3	0	0	0	0
New Hampshire	7	0	1	1	0	8	5	5	17	2	6	7	7	7	4	0	2	3
New Jersey	7	1	6	3	1	8	5	3	33	3	5	6	5	5	4	0	2	4
New Mexico	7	3	4	1	0	8	3	1	15	6	3	4	4	5	3	0	1	2
New York	36	2	35	15	5	96	47	6	253	39	42	72	73	77	25	0	33	30
North Carolina	7	0	6	1	0	9	5	1	23	5	6	6	6	8	2	0	1	1
North Dakota	9	0	8	1	0	17	7	5	22	6	7	8	11	12	1	1	4	5
Ohio	32	4	25	11	2	66	30	11	157	31	23	35	37	49	18	0	24	18
Oklahoma	14	4	9	3	1	14	7	3	43	10	9	10	11	11	3	0	3	4
Oregon	10	2	8	3	2	19	14	1	44	14	15	15	16	14	3	0	2	0
Pennsylvania	32	4	25	13	2	47	31	9	127	25	26	32	34	35	13	1	14	15
Rhode Island	4	1	3	1	0	5	2	0	9	4	4	5	5	4	2	0	5	3
South Carolina	7	4	3	0	0	3	1	0	4	3	2	3	2	3	2	0	2	0
South Dakota	14	2	11	3	0	19	8	2	36	9	7	11	17	18	4	1	4	1
Tennessee	6	0	6	2	0	10	5	0	20	6	5	11	6	8	3	1	3	2
Texas	32	6	23	11	2	50	17	10	120	24	19	32	34	38	13	4	13	7
Utah	3	0	3	2	0	7	5	2	18	6	4	7	6	6	1	0	1	1
Vermont	4	0	4	0	0	5	4	0	13	4	3	3	4	5	3	0	2	2
Virginia	8	1	7	6	0	10	7	5	37	6	7	8	7	8	6	2	5	4
Washington	13	2	8	4	2	46	10	1	65	15	16	34	18	41	6	4	5	2
West Virginia	3	0	3	0	0	3	2	0	8	0	3	2	3	3	2	0	1	0
Wisconsin	20	6	14	11	1	32	15	9	89	15	14	19	20	26	15	0	15	5
Wyoming	2	0	2	0	0	2	2	0	7	2	2	2	2	2	1	0	1	0
Totals	589	99	451	179	42	1045	486	143	2553	501	467	705	721	826	295	34	271	218

Where the difference between columns one and three does not equal column two it is due to a service such as sale, testing, etc. or to the occupation of the field by private or army and navy planes.

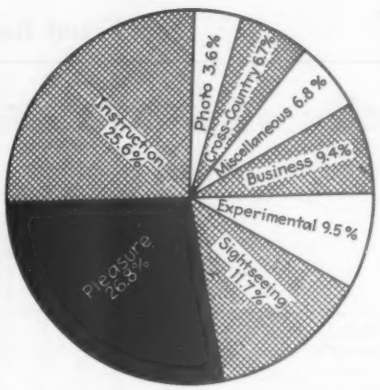
of over 400 hours a year. Only 11 per cent ran at the rate of over 200 hours, and only 35 per cent at over 100. Excluding transport operations, it appears that about three-quarters of the total amount of flying is done by about 45 per cent of the total number of airplanes. The average amount of flying per plane was at the rate of 120 hours per year, as against a general average of 200 hours in 1930. The amount of activity reported by identified planes was almost negligible. The table printed on page 128 shows a total of 10,800 planes in the United States and possessions, but about 3,600 of them, including the transport line ships, appear to account for 80 per cent of all the flying.

Flying time per plane low

The very limited amount of use that most airplanes get is still better shown by an analysis of the figures on the machines used for purposes of pleasure, either exclusively or in connection with some commercial operation. Barely 20 per cent of the owners fly as much as two hours a week, and that 20 per cent (some 600 of them in the whole country) do about half the non-commercial flying that is done. Only half of those flying without commercial incentive manage to average an hour a week.

It has been reported from time to time since 1929 that there are about 500 flying schools in the United States. It would appear from these figures that, if the term "school" is to be interpreted as meaning an organization with any facilities other than an airplane, there are at the outside about 225 schools and very probably not over 150. If, on the other hand, it is to include every one who attempts to give flying instruction, both the sources here used are in agreement in suggesting that the correct figure is about 1,000.

As will be observed from the large table, in every part of the country instruction runs "hop flying" and cross-country taxi operations a close third as the most popular commercial activity for airplane owners. Eighty per cent of all those who engage in any commercial activity are carrying passengers for short flights, while just under 70 per cent do taxi work and almost the same number teach. Just over 500 announce themselves as dealers. Allowing for the fields from which no questionnaires were returned, that figure would rise to around 650 for the country as a whole. So that if every commercial airplane built last year had been sold through a dealer the average business done by each one would have been just under three planes, and the average gross income, at the conventional rate of commission, about $6,000. If allowance be made for the effect of direct-from-factory sales, and for the activities of a dozen large distributors, there remain some 600 dealers whose average sales last year were two planes each and who had an average gross income of about



Distribution of 1931 flying hours of 500 non-transport planes

$1,250. Obviously, they cannot support themselves and their running expenses out of any such sum, and they therefore cannot afford to make selling their real business. Until there are many less "dealers" functioning or many more planes sold, selling will remain a side-line in most cases, and a side-line business is seldom conducted with the greatest possible measure of efficiency.

It is somewhat surprising to find less than 30 per cent of all operators undertaking to do photographic work, and even more surprising that 26 per cent announce themselves as engaged in advertising and 21 per cent in exhibition flying. The demand for exhibitions is now quite restricted, especially since state law has virtually put an end to wing-walking displays, and it is probable that many of those in the advertising group confine their advertising activities to the acceptance of a few dollars for painting some local merchant's sign on the fuselage of the plane, suggestions which find confirmation from the reports of flying time, as exhibitions and advertising together account for only 0.4 per cent of the total. The general impression, from an examination of the figures as a whole, is that everything is spread out too thin, and that there is not nearly enough specialization.

The entire absence of any crop dusting operations in the table of course has no significance. The planes selected for analysis were all located in a section of the country where dusting is of little importance. A study in Texas and Louisiana would show very different results on that particular point.

Analysis of aircraft operations for a selected group of planes, first six months of 1931

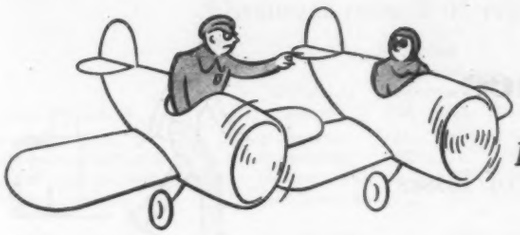
Number of owners reporting	273
Number engaged in some commercial activity	167
Total of licensed planes covered	583
Approved school dual instruction (hours)	1,320
Non-approved school dual instruction (hours)	2,100
Approved school solo instruction (hours)	2,286
Non-approved school solo instruction (hours)	2,401
Total instruction flying (hours)	8,107
Total experimental flying (hours)	2,853
Aerial advertising (hours)	46
Crop Dusting (hours)	0
Cross-country and taxi (hours)	1,940
Exhibition (hours)	62
Photo and survey (hours)	1,010
Business flying (hours)	2,814
Competition (hours)	54
Sight-seeing (hours)	3,422
Other commercial flying (hours)	1,885
Total commercial flying (hours)	22,193
Pleasure flying (hours)	8,261
Number of passengers carried for hire	51,979
Number of passengers carried free	12,590
Total flying time reported (hours)	30,454

Sight-seeing still leads

As might have been expected, "hop flying" or sight-seeing is the most widely diffused of all flying activities. Not only are the largest number of operators engaged in it, but the available business is distributed much more evenly among them than is true of other types of flying. Of 167 owners in the group surveyed who reported some form of commercial activity, 40 per cent reported an average of at least a half hour a week of local passenger carrying, and 6 per cent were showing over four hours a week. The ten largest operators, who on almost every other type of commercial flying had accounted for at least 60 per cent of the total operation and in some cases for as much as 90 per cent, got only 44 per cent of all the sight-seeing work. It is of interest to note that among the very largest operators some tendency toward specialization is apparent, for five of the ten flying services most active in "hop flying," including two of the leading three, were not among the leaders in any other type of work. A possible reason for this, of course, is that "hop flying" has its greatest popularity in districts where aviation is still comparatively unfamiliar and where, as a result, there is still very little demand for taxi service, photography, and the like.

On the whole the large operators organize the business to get more revenue per unit of flying time than do the small ones. Although the ten leaders had only 44 per cent of the time on "hop flying," they carried 67 per cent of the passengers. The three largest operators, whose records are of unimpeachable accuracy, had 13 per cent of the total sight-seeing flying time and carried 40 per cent of the passengers. They averaged from 30 to 50 passengers per hour of flying. Presumably the usual practice is to carry from two to four passengers at a trip, but to run 50 passengers a flying hour there must be much use of large cabin machines.

The distribution of activity in 1931 was similar in most respects to that shown by a survey made from the same Department of Commerce records the previous year on behalf of *Airway Age*. Most notable changes are the decrease of the relative importance of instruction, from three-eighths of the total hours of flying to barely a quarter and the increase of business flying from 7.1 to 9.2 per cent.



Aviation law

How many licenses to fly, and how much gas tax?

STATE licensing law no longer perplexes as much as it used to. The requirement of a federal license is now so nearly universal that there are only two rules to be followed. (1) Get a federal license for your plane and yourself. (2) If you haven't one, and if you live in one of the few states that doesn't require it, plan to stay very close to home.

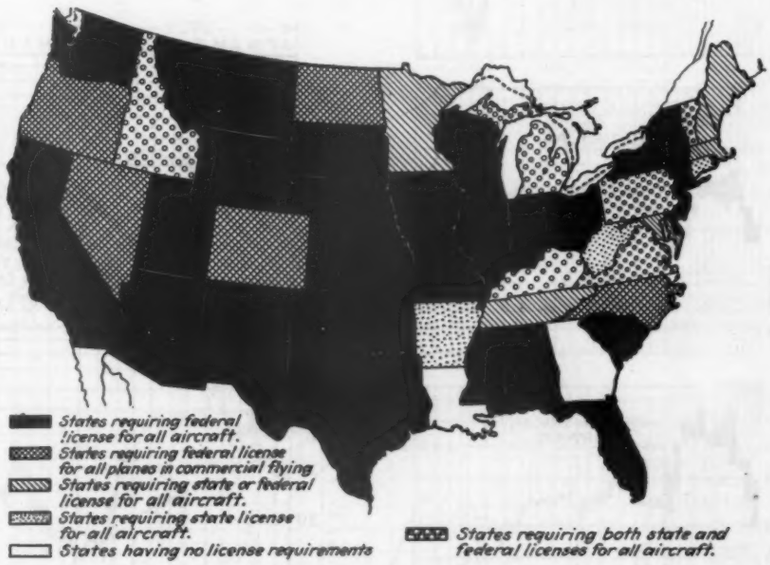
The geographical grouping of the states in respect of their law-making inclinations is very sharply defined. Not a single state west of Kansas City permits commercial flying within its boundaries without a federal license, and all but four require a federal license for all flying. Of the 31 states east of the same line (not including the states immediately to the west of the Mississippi) two make no requirements whatever, six accept either a federal license or that issued by the state (and sometimes issued after a rather cursory inquiry), and three require the state license in all cases without mention or recognition of the Department of Commerce. Superposition of state and federal licenses is gaining in favor.

On the lower map, which shows the aviation gas taxes collected by the various states, the geographical blocs are even more evident. Of the eleven states which collect a tax of 5 cents a gallon or more on aviation fuel, ten are grouped in a solid block in the southeastern corner of the country. Of the remaining 37 states, 29 leave aviation fuel free of all tax, either by specific exemption or by provisions for refunding the tax after its collection on proof that the fuel was used in aircraft.

Among the nine northern states that collect some tax on aviation fuel, several apply the proceeds directly and specifically to aeronautical purposes, such as the building of landing fields or the lighting of airways. Relatively few of the ten southern commonwealths in the high-tax group earmark the gas tax proceeds in any such fashion.

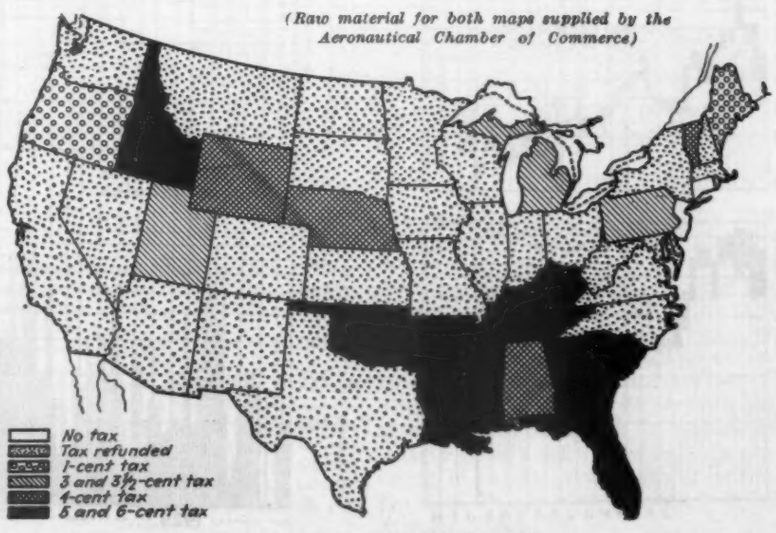
The map applies to the tax collected on fuel used in private and transient flying. In a few instances the tax is either reduced or entirely cancelled in the case of fuel used in regular scheduled interstate transport, or even on that used in any transport operation.

Obviously, as a matter of common justice, the aeronautical world is opposed to seeing a tax collected on aviation fuel go into the general funds of the state or into the highway fund, aviation deriving no direct benefit. There are marked differences of opinion upon whether or not a tax earmarked specifically for aeronautical work is desirable. Some aviation interests favor it, others are virulently in opposition. It is worthy of note that the three states that are most often held up to high praise for their far-sighted attitude in connection with aviation and for their generous outlays in support of the development of air navigation facilities, Idaho, Michigan, and Pennsylvania, all collect a gas tax, and in one case a very high tax. Furthermore, all three insist upon a state in addition to a federal license and two of them collect an annual license fee on all aircraft operating within the state, so deriving still more revenue for airway development work.

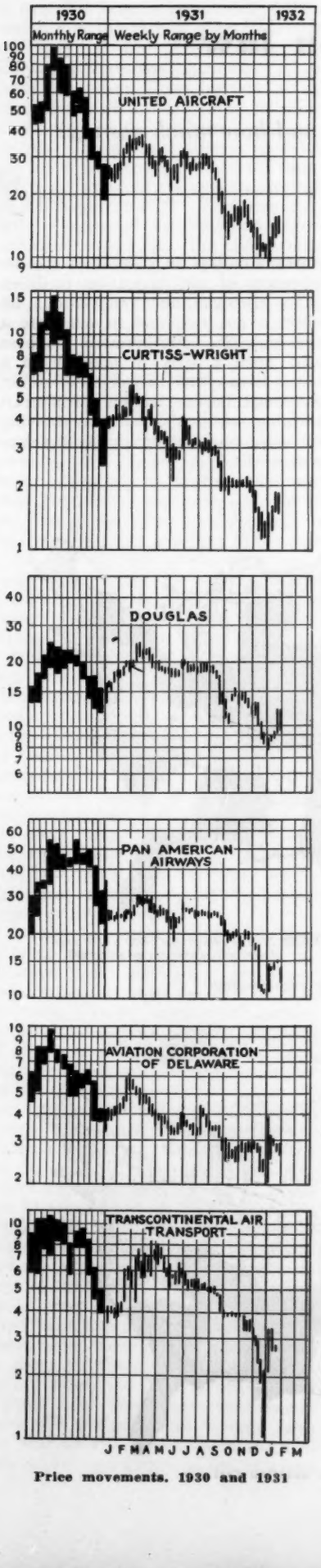

States requiring federal license for all aircraft.
States requiring federal license for all planes in commercial flying
States requiring state or federal license for all aircraft.
States requiring state license for all aircraft.
States having no license requirements
States requiring both state and federal licenses for all aircraft.

State laws' licensing requirements

(Raw material for both maps supplied by the Aeronautical Chamber of Commerce)



Gas tax burdens on aviation fuel


1930
1931
1932
Monthly Range
Weekly Range by Months
UNITED AIRCRAFT
CURTISS-WRIGHT
DOUGLAS
PAN AMERICAN AIRWAYS
AVIATION CORPORATION OF DELAWARE
TRANSCONTINENTAL AIR TRANSPORT
J F M A M J J A S O N D J F M A M J J A S O N D J F M

Price movements, 1930 and 1931

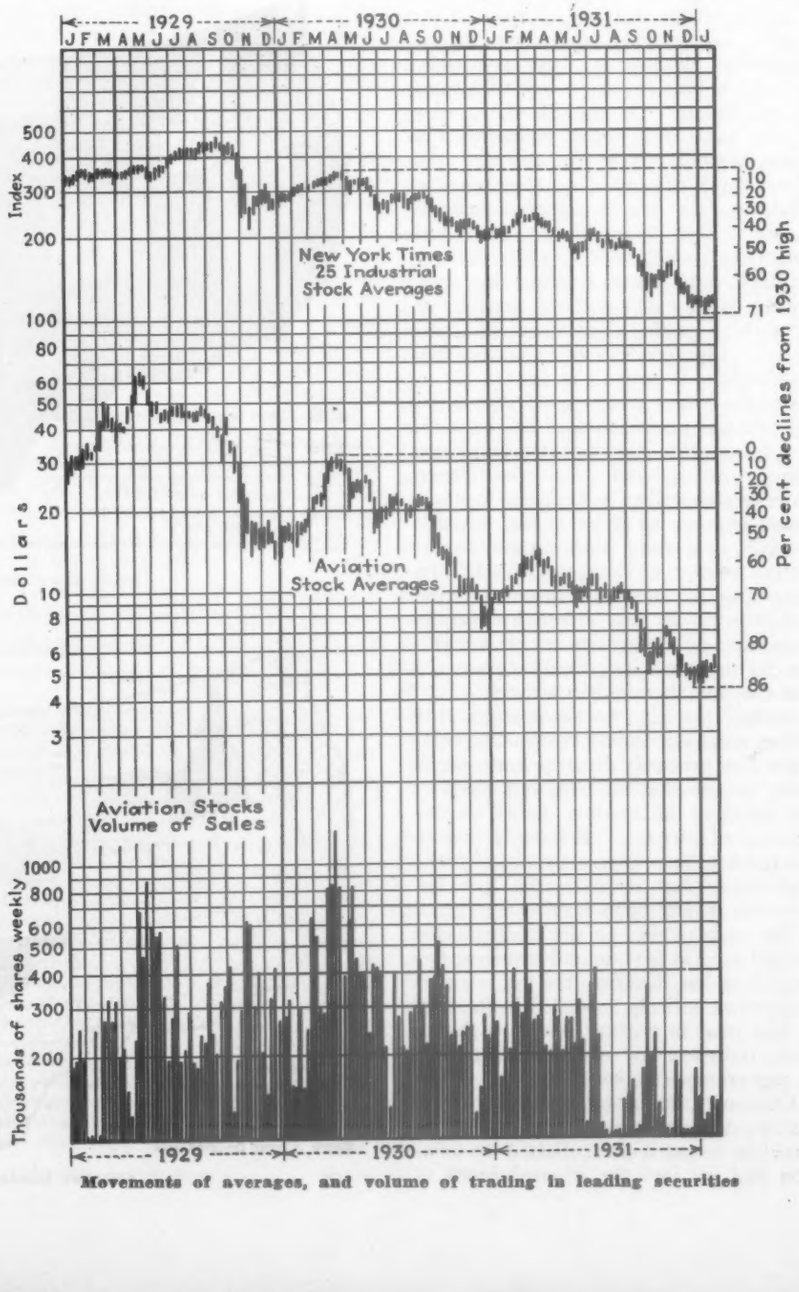
Finance

A curtailment of losses

Prepared by R. R. Doane

THE outstanding feature of aeronautical earnings during the year 1931 has been the marked curtailment of losses. A study of the tabulated earnings on the accompanying page indicates a reduction of some 60 per cent in total losses suffered during 1931, as compared with the preceding year.

The relative position of the industry, from the standpoint of total earnings when compared with general industry, is naturally small; but when viewed from the standpoint of relative earnings to gross volume of business transacted the aeronautical industry presents a far more favorable picture. Of the eight aero companies composing the AVIATION Stock Averages only *three* were able to show a net profit for 1930, as against *four* showing a net profit during 1931. The total aggregate losses of this group approximated $15,000,000


1929
1930
1931
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J
Index
New York Times 25 Industrial Stock Averages
Per cent declines from 1930 high
Dollars
Aviation Stock Averages
Aviation Stocks Volume of Sales
Thousands of shares weekly

Movements of averages, and volume of trading in leading securities

Financial record of representative aeronautical companies

Name of company	Division of industry	Capital Number of shares (000 omitted) Pfd.	Com.	Par Value	Original offering price (dollars)	Market	Securities price range 1930 High	1930 Low	1931 High	1931 Low	Year's Volume	Earnings (*Italics represent deficiencies*) 1929	1930	1931
Aero Supply Mfg., "B"	Accessories	21	391	No	15.00	C	13⅞	3½	4½	1½	5,800	223,418	*194,568*	.....
Air Investors, Conv. pfd.	Investment	82	...	No	.....	C	24	4	9	2⅛	18,600	125,568	*1,617,199*	.....
Aviation Corporation of Delaware	Holding Corp.	..	3,185	No	20.00	AHJ	9⅞	2⅛	6⅛	2	802,260	*1,443,822*	*4,703,601*	[9]*917,907*
Bellanca Aircraft	Manufacturing	..	175	No	23.50	C	18⅛	2⅛	5	1	6,900	*109,148*	*324,138*	.....
Consolidated Aircraft	Manufacturing	..	579	No	25.00	C	27½	6⅛	10⅛	⅛	14,600	952,027	127,091	.....
Curtiss-Wright, com.	Holding Corp.	..	6,284	No	30.00	AH	14⅛	1⅛	5⅛	1	1,922,181	*668,532*	*9,374,944*	[9]*7,159,255*
Curtiss-Wright, "A"	Holding Corp.	1,130	....	No	.....	A	19⅛	3	8⅛	1⅛	300,220	*668,532*	*9,374,944*	[9]*7,159,255*
Curtiss Aeroplane & Motor†	Manufacturing	..	19	No	.....	A	...	...	21⅛	5½	360			
Wright Aeronautical†	Manufacturing	..	600	No	.....	A	59½	10⅛	27	7⅛	310	624,000	555,002	[9]*96,804*
												900,837	*2,198,424*	[9]*1,932,189*
Dayton Airplane Engine	Manufacturing	..	100	No	16.50	C	8⅛	1⅛	2⅛	7/8	520,870	.....	.....	.....
De Havilland (Am. Rights)	Holding	..	400	$4.86	.....	C	8⅛	4⅛	5⅛	2	1,500	1,146,960	177,499	134,753
Detroit Aircraft	Holding	..	888	No	15.00	CFDHJ	9⅛	1⅛	3⅛	⅛	329,618	*733,077*	.....	.....
Douglas Aircraft	Manufacturing	..	399	No	.....	AIG	23⅛	11⅛	21⅛	7⅛	71,600	403,363	689,849	689,650
Fairchild Aviation	Manufacturing	..	560	No	22.00	C	11	⅛	5	⅛	45,200	*2,094,479*	*871,522*	[9]*9,252*
General Aviation (Fokker)	Manufacturing	30	950	No	12.50	CHJ	34⅛	4⅛	12	2⅛	165,700	403,937	*2,133,857*	.....
Great Lakes Aircraft	Manufacturing	..	500	No	.....	E	8⅛	1	5⅛	1	291,150	*848,841*	*685,554*	[9]*184,307*
Irving Air Chute	Accessories	..	211	No	25.00	CH	27	6	11	2⅛	47,200	444,745	241,697	184,046
Kinner Airplane & Engine	Manufacturing	..	1,946	$1.00	.....	JH	1⅛	⅛	4⅛	.90	119,802	*38,906*	.....	.....
National Aviation	Investment	..	234	No	.....	C	21⅛	3⅛	10	2⅛	79,100	241,992	*1,677,070*	.....
North American Aviation	Holding	..	2,000	No	.....	ADH	15⅛	4⅛	11	2⅛	1,183,800	1,908,819	1,911,110	.....
Pan American Airways	Transport	..	321	No	X	C	55	16⅛	30⅛	11	78,800	*317,418*	*305,271*	.....
Roosevelt Field	Airport	..	360	No	.....	CF	5⅛	1⅛	3⅛	⅛	23,500	68,400	*122,305*	1,265
*Transcontinental Air Transport	Transport	..	750	No	.....	CGL	10⅛	3⅛	8⅛	1⅛	152,800	*986,691*	*895,059*	.....
United Aircraft & Transport, pfd.	Holding	240	...	No	.....	AH	77⅛	41⅛	61⅛	40	86,800	8,966,031	3,337,949	†2,800,000
United Aircraft & Transport, com.	Holding	..	2,084	No	30.00	AHJ	99	18⅛	38⅛	9⅛	8,208,900	8,966,031	3,337,949	†2,800,000
Waco Aircraft	Manufacturing	..	145	No	23.50	M	10⅛	3	4⅛	1	.....	109,000	*106,550*	[9]*54,026*
Warner Aircraft	Manufacturing	..	400	No	.....	KP	9⅛	⅛	3⅛	⅛	195,527	*39,965*	*129,193*	.....
*Western Air Express	Transport	..	135	$10.00	45.00	CIH	46⅛	9⅛	22	4	40,200	1,087,852	*200,670*	[9]12,126

*T. A. T. and Western Air Express own jointly the capital stock of Transcontinental and Western Air, Inc. A close corporation for which reports are not available.

†Controlled by Curtiss-Wright.

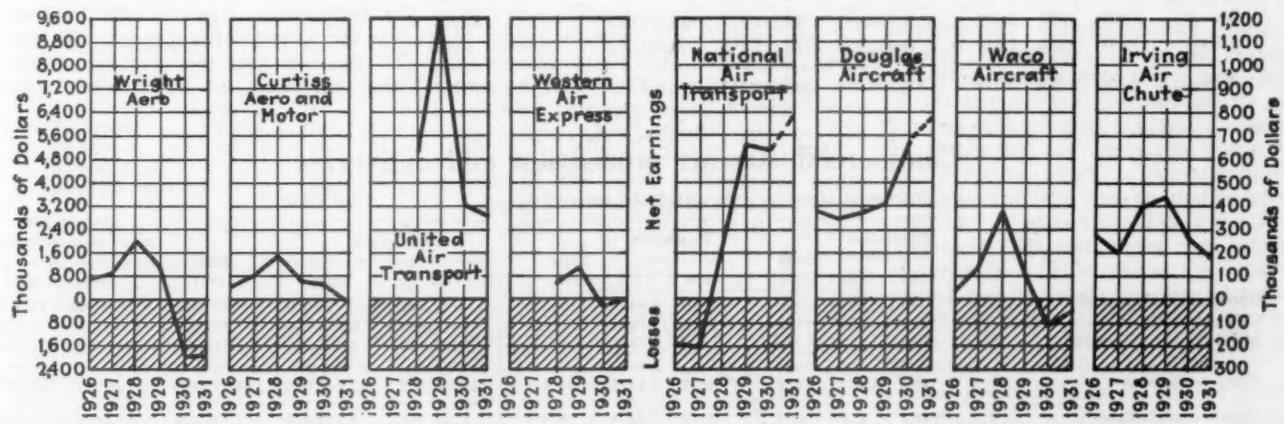
XOffered privately.

†Preliminary report.

A New York Stock Exchange
C New York Curb Exchange
P New York Produce Exchange
D Boston Stock Exchange
E Chicago Stock Exchange
M Cincinnati Stock Exchange
H San Francisco Curb Exchange
F Chicago Curb Exchange
I Los Angeles Stock Exchange
J Los Angeles Curb Exchange
K Detroit Stock Exchange
L Cleveland Stock Exchange
G San Francisco Stock Exchange

[6] Three months only
[8] Six months only
[9] Nine months only

Figures given in the above table, while not guaranteed, are from sources believed correct.



in 1930 as against $6,000,000 for 1931, while the total aggregate profits remained substantially the same as during the year previous. For this group of representative companies the ratio of dollars lost to dollars gained stood at 3.75 to 1 in 1930, as against about 1.75 to 1 in the year just passed. Negative as these results must still appear, they at least disclose encouraging signs of fundamental improvement that should not be overlooked.

The following comparisons bring out some interesting relative changes:

	1930 high	1931 low	Per cent change
General business activity[1]	97	62	—36
25 industrial stock price[2]	358	111	—69
Industrial earnings index[3]	54	29	—46
Aviation stock averages[4]	32	4	—86
Aviation company earnings[5]	33	28	—15

[1]New York *Times Annalist* Index. [2]New York *Times* Index. [3]Standard Statistics, Inc., Index. [4]AVIATION. [5]Computed from earnings changes of the following companies: Transcontinental Air Transport, National Air Transport, Western Air Express, Pan American Airways, Aviation Corporation of Delaware, Douglas Aircraft, Curtiss-Wright and United Aircraft and Transport.

It will be noted from the above tabulation that aero securities declined, proportionately, some 17 per cent farther than general industrial stocks, and that the decline in market value of the capital stocks of these companies was some 70 per cent greater than was the decline in earnings of these same companies. There is no particular ill omen in this movement, as such lack of correlation may be chiefly due to the public's confusion of values as well as the general plight of the speculative investor in his enforced liquidation.

Production and licensing

Who owns all the planes? And when will they buy more?

PRODUCTION of commercial aircraft in 1931, as reported to the Chamber of Commerce, was 19 per cent lower than in 1930 in number of machines, and 39 per cent lower in total value. The average value showed a drop of 25 per cent, due in large part to the advent of the light plane during the past year. Forty-four per cent of all the machines produced were in the light class. It is noteworthy, however, that the total sales of light planes reported were inferior to the production by 20 per cent, while in most other classes sales exceeded the production. Total sales for the year were 5 per cent over total production, presumably making that much inroad on the accumulated inventory.

For the first time since production statistics have been reported, monoplanes are in a clear majority. Never before have they exceeded 41 per cent. This year they jumped to almost 65. Their gain was of course almost entirely at the expense of the open-cockpit biplane, which has always in the past constituted more than half the total production and in 1931 represented barely a quarter. All of the monoplane's gains were made in the light open-cockpit type. Cabin monoplanes suffered, relatively, almost as badly as the biplanes. For the first time in three years, open cockpit machines, monoplanes and biplanes together, made up more than 70 per cent of the total production in numbers. In gross value, however, the open types aggregated but 34 per cent of the total.

The autogiro presents a new element, and a very substantial one—more than 6 per cent of the total commercial production in dollar value.

Among the striking changes from 1930 to 1931 were increases of more than 100 per cent in the relative importance of the multi-engined transport monoplane and of the cabin biplane. In both cases, however, the increase was due almost entirely to a single type. To the fact that the machine responsible for most of the multi-engined

Commercial engine production and sales

	Number of planes			Value			Average unit value production	
	Production		Sales	Production		Sales		
Horsepower	1930	1921	1931	1930	1931	1931	1930	1931
0-75	215	749	680	$158,213	$452,705	$404,790	$737	$604
76-125	678	341	361	1,277,884	584,905	647,560	1,884	1,710
126-175	68	157	173	165,248	286,071	345,547	2,430	1,820
176-225	280	311	331	604,600	674,770	707,915	2,159	2,170
226-300	260	124	158	1,094,895	560,360	691,290	4,211	4,510
301 and up	424	294	306	2,954,653	1,633,420	1,778,910	6,968	5,540
Total commercial	1,925	1,976	2,009	$6,255,493	$4,192,231	$4,576,012	$3,250	$2,110
Military	1,841	1,800	1,827	10,823,423	10,417,718	10,687,541	5,879	5,780
Grand total	3,766	3,766	3,836	$17,078,916	$14,609,949	$15,263,553	$4,535	$3,869

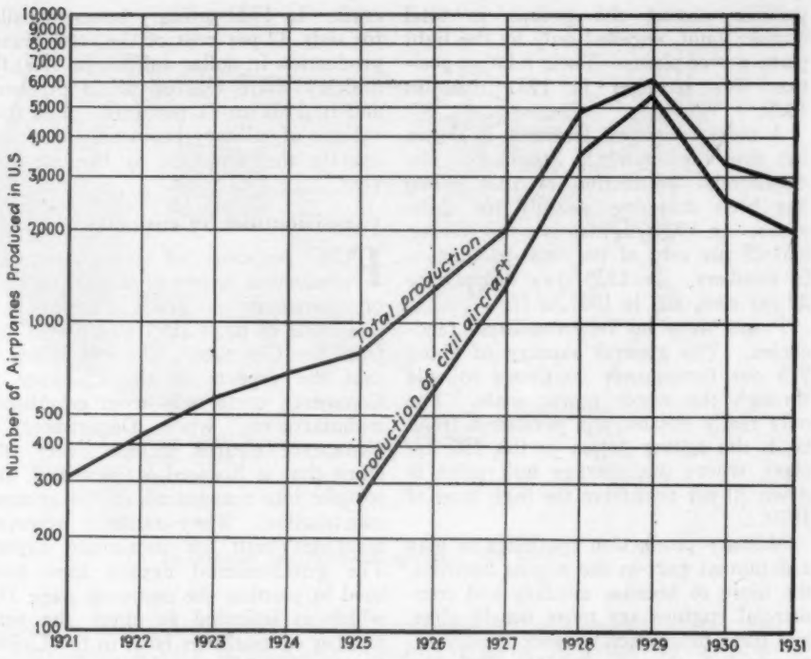
Commercial aircraft production and deliveries

	Number of planes			Per cent of total commercial			Total value			Average unit value of production	
	Production		Sales	Production		Sales	Production		Sales		
	1930	1931	1931	1930	1931	1931	1930	1931	1931	1930	1931
Open cockpit monoplanes	250	704	566	12.9	44.5	34.1	$731,990	$917,878	$739,387	$2,928	$1,300
Cabin monoplanes	505	254	391	26.1	16.0	23.6	3,417,543	1,308,924	1,919,554	6,767	5,150
Multi-engined transports	38	63	71	1.9	4.0	4.3	1,389,984	1,342,206	1,514,082	36,578	21,270
Total monoplanes	793	1,021	1,028	40.9	64.5	62.0	$5,539,517	$3,569,008	$4,173,023	$6,985	$3,495
Open cockpit biplanes	1,083	424	496	55.9	26.8	29.9	3,166,310	1,355,340	1,520,624	2,924	3,195
Cabin biplanes	20	45	37	1.0	2.9	2.2	285,880	351,350	317,793	14,294	7,800
Multi-engined transports	7	2	3	0.4	0.1	0.2	505,581	136,000	204,000	72,226	68,000
Total biplanes	1,110	471	536	57.3	29.8	32.3	$3,957,771	$1,842,690	$2,042,417	3,566	3,920
Total open cockpit	1,333	1,128	1,062	68.8	71.3	64.0	3,898,300	2,273,218	2,260,011	2,924	2,010
Total cabin	525	299	418	27.1	18.9	25.8	3,703,423	1,660,274	2,237,347	7,055	5,550
Total multi-engined transports	45	65	74	2.3	4.1	4.5	1,895,565	1,478,206	1,718,082	42,124	22,750
Total landplanes	1,903	1,492	1,564	98.2	94.3	94.3	$9,497,288	$5,411,698	$6,215,430	$4,990	$3,625
Amphibions and flying boats	34	39	48	1.8	2.4	2.9	1,248,755	835,359	1,064,301	36,728	21,410
Autogiros	....	51	46	.....	3.3	2.8	.....	408,681	377,086	.....	8,250
Total commercial	1,937	1,582	1,658	100.0	100.0	100.0	$10,746,043	$6,655,738	$7,656,827	$5,548	$4,208
Military	747	812	811	.....	.....	.....	10,723,720	12,971,028	13,216,761	14,356	15,974
Grand total	2,684	2,394	2,469	.....	.....	.....	$21,469,763	$19,626,766	$20,873,588	$7,999	$8,198

transport production sells at a price well below the usual range of such planes in the past can also be attributed a drop of 41 per cent in the average unit value of the multi-engined monoplanes built. Open-cockpit biplanes remain about as in the past in price, as the disappearance of the war surplus engines has resulted in transferring to the light planes a large part of what used to be the normal market for the open three-seater. The open-cockpit biplane is now finding a substantial portion of its total outlet as a de luxe high performance machine for wealthy sportsmen pilots, and average prices are tending to rise as a result. The cabin monoplane, on the other hand, which is gradually cornering the general service business-travel market, shows a 25 per cent drop in average unit value for the year. The drop is not due to decrease in the average size of the machines included, for the average seating capacity of the single-engined cabin monoplanes produced has decreased only from 4.5 in 1930 to 4.3 in 1931.

Amphibions and flying boats show a small gain in numbers built but, notwithstanding the construction of two machines of unprecedented size, a substantial reduction in average and in total value. The drop is due to the substantial abandonment during 1931 of production on amphibions and flying boats of from eight to twelve-passenger capacity. Sixty per cent or more of the machines built were light amphibions and boats, accommodating not more than six passengers and in most cases not more than three.

Military business showed a slight improvement over 1930, an increase of 9 per cent in numbers and 20 per cent in value. For the first time since 1927 it furnished more than half of the airplane-manufacturing industry's gross income. In 1930 the commercial and military branches were almost equal, the latter very slightly inferior. In 1931 the military accounted for 66 per cent of the total. Obviously, under present conditions it is almost entirely to military business that the largest groups in the industry must look to carry their overhead if they are to keep their organizations alive and efficient.

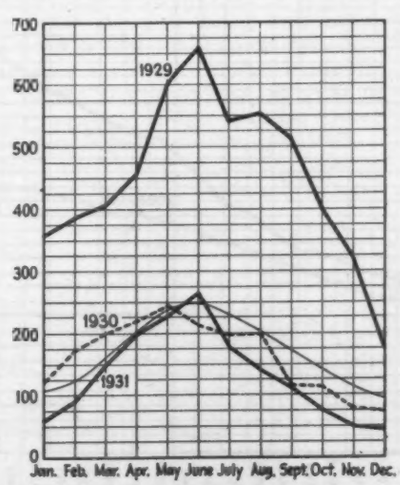


Airplane production, 1921 to 1931

1931 aircraft production

	Department of Commerce Reports	Chamber of Commerce Reports
Open cockpit monoplanes	920	704
One-place	281	206
Two-place	625	495
Three-place	14	2
Cabin monoplanes	338	317
One-place	5	0
Two-place	46	33
Three-place	13	1
Four-place	154	162
Five-place	10	11
Six-place	15	26
Seven-place and up	95*	84*
Total monoplanes	1,258	1,021
Open cockpit biplanes	407	424
One-place	40	20
Two-place	144	172
Three-place	188	190
Four-place and up	35	42
Cabin biplanes	34	47
Total biplanes	441	471
Total landplanes	1,699	1,492
Amphibions and flying boats	38†	39
Convertibles*	8	...
Autogiros*	60	51
Experimental planes	2	...
Airplanes exported	140	...
Total commercial planes	1,947	1,582
Military airplane deliveries	853	812
Grand total	2,800	2,394

*58 multi-engined transport planes included in Department of Commerce figure and 63 in Chamber of Commerce report. **Chamber of Commerce classifies these under landplanes. †Eight multi-engined transport planes.



The seasonal swing of production (machines per month)

(Discussion on page 120)

Engine production in 1931

AS INDICATED on page 125, there still is a considerable use of old types of engines in airplanes of current manufacture. Nevertheless, a substantially normal relationship between airplanes and engines would appear to have been reached. For the first time in three years the production of engines is well in excess of that of planes. Allowing for the generally shorter life of an engine, for the desirability of having replacement engines available for planes that are intensively operated, and for the effect of multi-engined planes on the total figures, that is what ought to be expected. The excess of engines in 1931 was 33 per cent, which is probably a little above the proper normal and may indicate some increase in the stock of unused engines in the hands of airplane manufacturers and of operators at the end of the year.

The principal changes of the year, as compared with previous records, were an increase in the production of engines of very low power, which was of course accounted for by the newborn popularity of the light plane, an increase in those of about 150 hp., and a sharp drop in the 100-hp. class. The changes are less notable than at first appears, for the apparent increase in production around 150 hp. is simply a return to normal after a very slack year. Over-production in 1929 appears to have left enough engines of that type on hand to take care of almost all demands through 1930. The 100-hp. engines, in spite of their decline in relative popularity, still stand in second

position among the groups in total number built, excelled only by the light plane power plants. Their relative position was stronger in 1931 than in 1929.

A more consistent tendency is shown by the high-powered engines. The commercial production of that group has been dropping steadily for three years. In 1929 engines of over 300 hp. had 25 per cent of the total production in numbers. In 1930 they dropped to 22 per cent, and in 1931 to 15.

Prices show no very consistent tendencies. The general average of about $15 per horsepower continues to rule through the whole power scale. The only really notable and persistent trend is in the falling prices in the 150 hp. class, where the average unit price is down 30 per cent from the high level of 1929.

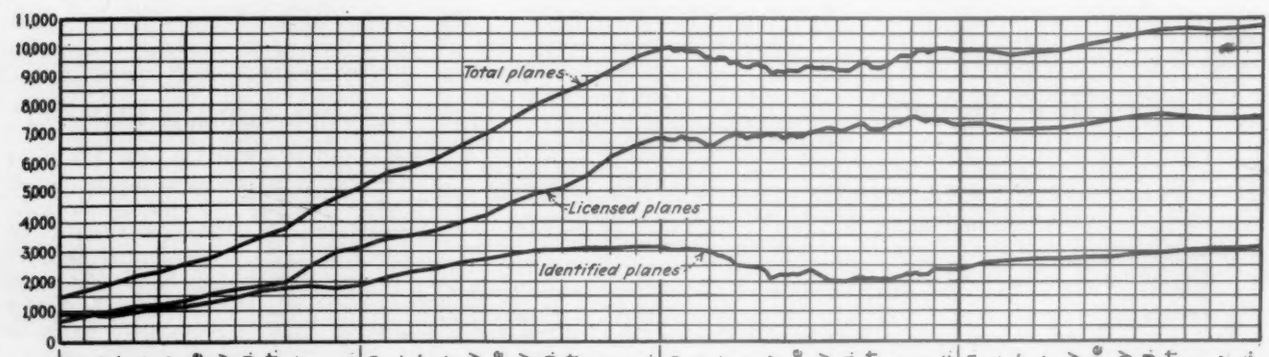
Military production continues to play a dominant part in the engine business, the more so because military and commercial engines are more nearly alike, and their production is more closely intermingled, than is possible with aircraft. In 1929 military business called for only 32 per cent of the total engine production in dollar value. In 1930 the military share was up to 63 per cent, and in 1931 to 71 per cent. The total volume of military business was almost exactly the same as in the previous year.

Classification by capacity

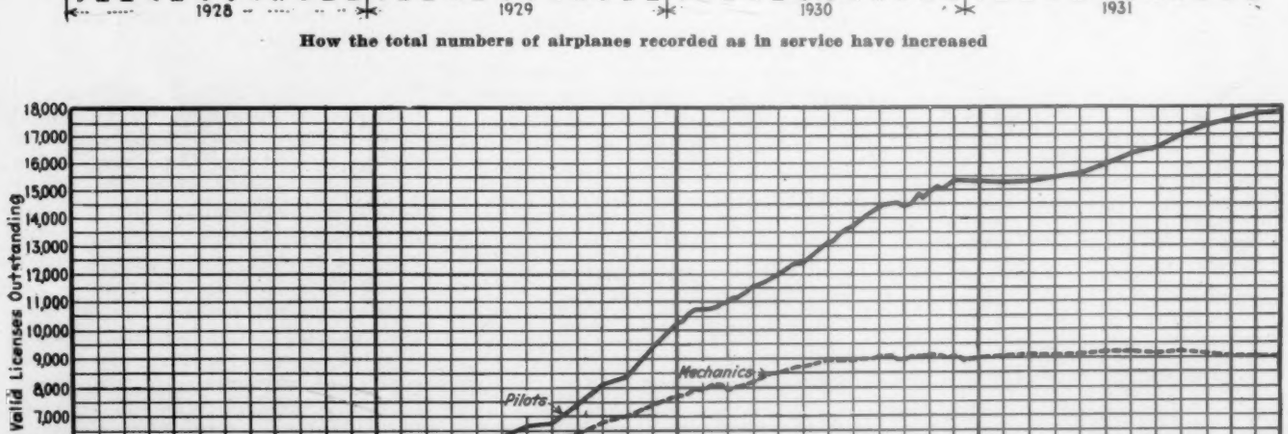
FOR purposes of comparison the production report of the Department of Commerce is given (at the left-hand side of page 119) along with that from the Chamber. The two differ in that the reports of the Chamber of Commerce come only from established manufacturers, while Department of Commerce figures include every machine that is licensed or identified, and so take into account all of the amateur construction. They exclude, however, machines built for immediate export. The governmental figures have been used in plotting the curve on page 119, which is intended to cover the total number of machines built in the United States, but for most purposes the analysis made by the Chamber of Commerce serves better.

Seasonal curves

In the seasonal production curve the Chamber's figures have been used. Records have now been kept for four years, and have furnished enough data to plot a normal curve of seasonal distribution of production. It has been included on the chart. The ordinates for which the smooth curve is actually drawn correspond to a total production of 2,000 planes for the year. Both 1930 and 1931, especially the former, as will be observed from the graph, have started much stronger than they finished. Throughout the spring and the early part of the summer the 1931 production curve followed closely the normal seasonal curve for a total production of 2,000 planes, but in the last four months it fell away badly. This falling away towards the end of the year is of course what would be expected with the general business depression getting steadily worse and all indices showing a downward tendency.



How the total numbers of airplanes recorded as in service have increased



The piloting personnel grows steadily,—total number of licenses outstanding

License trends

THE total number of planes nominally in service in the United States has increased very slightly in the past year. After a long period (sixteen months) during which the total number of licenses and identifications hovered between 9,000 and 10,000, it has moved up into a new range and stabilized again at between 10,000 and 11,000. Most of the increase in 1931 has been due to the identified planes, licensed machines showing a change of only about 300. It seems very probable from a variety of evidence, including detailed censuses of certain groups of airports around important centers of activity, that the official figures for identified planes actually exaggerate considerably the number of such machines that are in service. Identification numbers do not have to be renewed periodically, and the machines require no periodic inspection, so there is no way of being sure that they will be removed from the records in case of destruction or dismantling. Although the graph indicates 6,700 licensed planes and 3,100 identified at the end of 1931, it is probable that about 7,100 and 1,400, a total of 8,500, would more closely represent the number of planes actually fit for use on the last day of the year.

On the face of the record as published, in spite of many state laws requiring federal licensing of all planes, it would appear that very little progress is being made towards the elimination of the unlicensed craft. Never yet have the identified planes on the Department of Commerce records made up less than 20 per cent of the total.

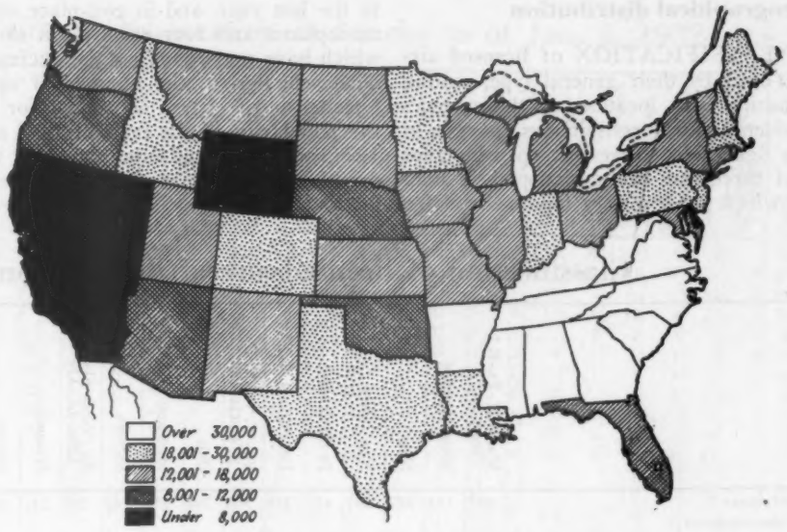
Pilots and mechanics

The curve of pilots' licenses in force is more encouraging. Although the slope has been less steep in 1931 than in previous years, the trend is still steadily upward. The number of licenses outstanding increased by 3,300 in 1928, by 5,300 in 1929, 5,100 in 1930, and 2,400 during the past year. It is a little surprising to find that the seasonal tendency in the curve is becoming more and more evident. In 1931 the flattening of the curve has been very marked, and two-thirds of the total gain for the year was made in five months, from May to September inclusive.

The distribution of pilots among the various classes, as well as their geographical distribution, is discussed on page 128.

The ratio of licensed pilots to licensed and identified airplanes has continued to increase almost steadily. Two years ago it was almost exactly unity. Last year the ratio had increased to 1.5, and now it stands at 1.65. If allowance be made for the identified planes that are presumed not to be in flying condition, there are probably more than two pilots to each plane actually fit to use. Obviously, a very large number of the licensed pilots, probably not less than 4,000, have no regular access to an airplane and are keeping up their flying only in a very desultory fashion.

The number of licensed mechanics is even more closely stabilized than the number of planes in service. For eighteen months it has never gone outside the range between 8,900 and 9,250.



Population per licensed airplane (by states)

Student permits as an index

THE curve of distribution of new student permits issued is the best record of current public interest in aviation. The curve of new pilots' licenses shows the same quantity, with a time lag of from four months to a year. Very naturally, therefore, the student permit rate reached its high in the late summer of 1929, while the peak on the pilot curve came in the early summer of 1930.

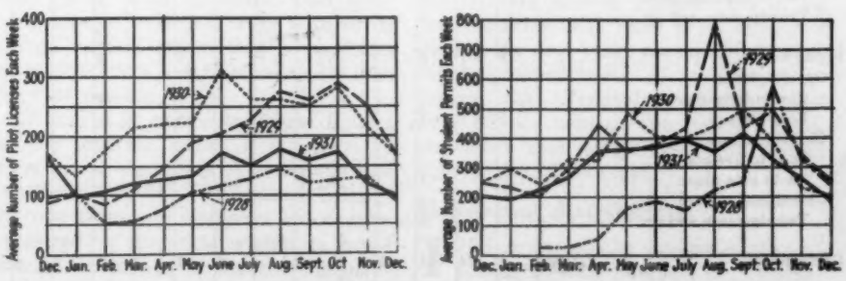
On the whole, the curves for 1931 have held up very well, especially on students, the total number of permits issued for the year being only about 2,500 below that for the previous year. The pilot curve was almost uniformly off 40 per cent from that of 1930 in every month, seldom varying more than 2 or 3 per cent from that level.

Both the curves for student permits and those for pilot licenses hold very accurately to a constant shape, and partial returns therefore serve nicely for prediction. Approximately 20 per cent of the student permits for a year are taken in the first three months.

The West proves air-minded

THE West continues to be the region of greatest density of airplane ownership. Of the nine states having the highest average of per capita ownership, seven are west of Kansas City. Only tiny Delaware is able to represent the East.

The strongest geographical tendency that the map reveals, however, is the sparsity of airplane ownership in the Southeast. Florida is a special case, most of the planes registered there being in some way connected with the state's popularity as a winter resort. Leaving Florida out of account, there is a solid block of ten states, including everything to the south of the Mason-Dixon line and east of the Mississippi river, and also Arkansas to the west of the river, that have less than one plane for every 30,000 people. Their average density of ownership is less than one-quarter that of California or Delaware. On the other hand, as noted on page 126, it is in the Southeast that some of the largest and steadiest of relative gains in number of planes licensed are to be found.



Pilots licenses (left) and student permits (right) newly issued each month for four years

Geographical distribution

CLASSIFICATION of licensed aircraft by their general type, seating capacity, and location of the owner's residence shows conspicuous changes in the figures for three-seat open biplanes and three-seat cabin monoplanes, both of which show a very heavy shrinkage in the last year, and in two-place open monoplanes and four-place cabin ships, which have undergone notable increase. The reduction in the number of open biplanes is of course accounted for by the popularity of the type in 1927 and 1928, and the rapid elimination at the present time of the machines built three or four years ago. The drop in three-passenger cabin machines is due to the high rate of attrition of the large groups of machines of that type built in 1929 and equipped with wartime engines.

Increases in numbers, of course, represent new production, and are in most cases attributable to the influence of one or two models. Thus, an in-

Classification of licensed aircraft by location, type, and capacity

	Me.-N.H.-Vt.-R.I.-Conn.	Massachusetts	New York	New Jersey	Pennsylvania	Del.-Md.-D. C.	Va.-W. Va.-N. C.-S. C.-Ga.-Fla.	Ohio	Michigan	Indiana	Ky.-Tenn.-Ala.-Miss.-La.-Ark.	Missouri	Illinois	Wisconsin	Minn.-Iowa	Kan.-Neb.	Oklahoma	Texas	N. M.-Ariz.-Col.-Utah-Nev.	N. D.-S. D.-Mont.-Wyo.-Idaho	Wash.-Ore.	California	Alaska-Hawaii-Foreign	Total
Landplanes	207	195	877	201	415	218	350	394	334	142	290	231	483	173	249	272	231	303	150	203	203	914	28	7063
Open biplanes																								
One-place	....	....	38	....	4	2	2	15	....	....	10	16	29	....	2	....	....	7	1	6	2	11	....	145
Two-place	39	39	131	32	51	30	49	40	42	11	38	20	71	21	14	45	15	31	25	6	25	149	3	927
Three-place	89	86	332	63	183	76	143	168	125	73	118	75	174	89	102	96	90	129	57	89	86	382	7	2832
Four and five-place	8	5	19	9	4	2	8	3	....	....	....	....	1	....	....	1	....	....	1	....	5	1	2	69
Open monoplanes																								
One-place	10	6	12	1	7	4	7	10	21	1	7	1	6	3	5	6	3	2	2	3	7	23	....	147
Two-place	17	14	53	28	45	15	35	33	21	20	37	20	39	14	7	33	17	28	17	15	10	62	1	581
Three-place	1	....	2	....	2	....	2	2	3	1	3	7	2	....	2	2	1	2	....	2	....	10	....	44
Five-place and up	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	2
Total open landplanes	164	150	587	133	296	129	246	271	212	106	213	139	322	127	130	183	126	199	103	121	136	639	13	4747
Closed biplanes																								
One to 4-place	1	....	3	1	2	4	2	10	5	1	1	3	3	1	1	....	3	1	....	5	1	3	....	51
Five-place	....	1	1	1	....	....	....	2	3	1	....	3	4	....	....	....	1	1	2	12	11	12	....	55
Six to nine-place	....	....	2	....	....	....	1	1	2	....	....	....	1	....	....	....	3	....	....	....	3	6	....	19
Ten to fourteen-place	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	1	....	3
Fifteen to nineteen-place	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	3
Twenty-place and up	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	1	....	....	10
Closed monoplanes																								
One and two-place	2	3	19	4	24	5	14	13	18	6	6	13	30	13	22	13	24	7	6	14	9	40	....	305
Three-place	14	15	56	17	18	10	29	32	18	14	25	21	32	9	36	20	23	21	12	18	9	49	....	498
Four-place	13	14	66	18	27	22	35	24	34	7	24	14	39	12	27	29	19	16	9	18	13	49	7	536
Five-place	2	5	25	5	12	5	7	12	15	4	7	9	7	3	7	6	6	13	3	5	6	19	2	185
Six-place	8	2	28	6	13	14	13	11	11	1	10	12	16	5	5	10	16	23	8	3	3	36	2	256
Seven to nine-place	1	3	31	6	7	5	3	7	5	2	4	12	4	1	13	8	7	9	6	1	5	25	4	169
Ten to fourteen-place	1	....	23	1	4	21	....	8	6	....	....	4	19	2	2	2	3	11	1	1	3	32	....	144
Fifteen to nineteen-place	....	....	18	4	....	....	....	1	1	....	....	1	6	....	2	....	....	1	....	....	....	1	....	35
Twenty-place	....	....	2	1	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Total closed	42	45	280	64	108	89	104	121	118	36	77	92	161	46	115	88	105	103	47	82	66	273	15	2275
Autogiros	1	2	10	4	11	....	....	2	4	....	....	....	....	....	2	1	....	1	....	....	1	2	....	41
Amphibions	11	6	59	3	7	3	6	10	8	....	7	....	7	1	1	....	....	....	....	....	5	6	5	145
Open biplanes																								
One to two-place	....	....	....	....	....	....	2	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	3
Three-place	....	2	9	....	....	....	....	1	....	....	1	....	1	....	....	....	....	....	....	....	2	....	....	16
Four to five-place	2	3	3	....	1	....	2	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	14
Open monoplanes																								
One to two-place	....	....	4	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Three to five-place	1	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Closed biplanes																								
Four to five-place	....	....	13	1	6	1	....	....	....	....	2	....	1	....	....	....	....	....	....	....	1	....	1	26
Six to nine-place	....	....	3	1	....	....	1	4	4	....	2	....	....	1	....	....	....	....	....	....	1	3	....	20
Ten to fourteen-place	4	....	20	1	....	....	....	1	....	....	....	....	4	....	1	....	....	....	....	....	....	....	3	34
Closed monoplanes																								
Two to six-place	4	1	5	....	....	....	1	2	1	....	1	....	....	....	....	....	....	....	....	....	1	....	....	16
Seven to nine-place	....	....	....	....	....	1	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	1	....	4
Ten to fourteen-place	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	3
Twenty-place and up	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Flying boats	3	1	8	....	....	....	1	2	3	....	2	....	....	....	....	....	....	....	....	....	5	....	....	25
Open biplanes																								
One to three-place	....	....	....	....	....	....	....	2	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	4
Four-place	3	1	1	....	....	....	1	....	3	....	....	....	....	....	....	....	....	....	....	....	1	....	....	10
Closed biplanes																								
Four to five-place	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	3
Six to nine-place	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	2
Closed monoplanes																								
Twenty-place and up	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Unclassified	2	4	11	6	2	1	....	6	7	....	5	1	6	....	1	1	1	1	1	....	....	16	....	72
Grand total	223	206	955	210	424	222	357	412	352	142	304	232	496	174	251	273	232	304	151	203	213	936	33	7305

Classification of licensed aircraft by location and make as of Jan. 2, 1932

	Me.-N.H.-Vt.-R.I.-Conn.	Massachusetts	New York	New Jersey	Pennsylvania	Del.-Md.-D. C.	Va.-W. Va.-N. C.-S. C.-Ga.-Fla.	Ohio	Michigan	Indiana	Ky.-Tenn.-Ala.-Miss.-La.-Ark.	Missouri	Illinois	Wisconsin	Minn.-Iowa	Kan.-Neb.	Oklahoma	Texas	N. M.-Ariz.-Col.-Utah-Nev.	N. D.-S. D.-Mont.-Wyo.-Idaho	Wash.-Ore.	California	Alaska-Hawaii-Foreign	Total
Aeronca	4	1	8	2	11	2	12	16	1	1	8	....	3	3	2	4	....	4	2	4	4	9	....	101
Alexander	4	5	24	1	8	3	17	7	15	8	6	7	5	7	11	10	9	17	15	31	17	37	1	265
American Airplane & Engine (Pilgrim)	11	11	85	8	57	27	20	14	7	2	3	4	16	4	3	....	....	10	2	....	1	16	5	306
American Eagle	9	3	21	1	17	1	9	13	7	9	16	17	15	13	18	19	8	14	6	12	6	23	1	258
Arrow	2	7	7	2	....	....	2	....	6	1	1	3	1	1	1	9	1	....	4	2	5	2	....	57
Bellanca	1	3	8	6	7	15	7	4	....	....	2	2	5	1	1	3	2	4	....	....	1	7	3	82
Bird	7	9	43	3	18	7	18	18	7	....	1	....	4	....	2	2	1	....	1	1	3	6	1	152
Buhl	4	4	6	....	2	3	4	4	25	1	2	1	4	3	4	1	6	2	....	1	4	15	....	96
Cessna	2	5	15	1	2	....	5	4	1	1	3	3	6	....	2	8	3	2	1	1	....	6	....	71
Commandaire	6	1	18	1	3	4	10	3	4	2	26	5	14	1	2	2	3	12	3	....	1	19	....	140
Consolidated	12	6	60	4	17	6	10	8	9	2	7	5	14	11	4	1	4	10	4	2	12	67	....	275
Curtiss-Wright																								
Fledgling	3	3	12	....	1	3	8	2	4	1	1	1	5	....	....	2	....	1	....	....	....	6	....	53
Junior	6	4	18	8	13	2	9	12	9	5	19	10	15	9	1	9	7	14	12	9	2	18	....	211
Keystone	....	....	17	3	7	1	1	4	4	....	10	....	1	....	....	....	....	....	....	....	2	3	1	54
Moth	8	11	14	9	2	5	8	4	1	1	5	4	6	3	2	2	2	3	6	....	....	12	....	108
Robin	12	16	37	14	20	9	32	23	17	14	27	21	29	10	32	19	19	21	14	18	8	42	....	454
Travel Air	23	18	63	21	39	18	37	34	26	21	30	26	54	16	23	58	34	47	18	26	19	122	2	775
Others	1	1	26	2	....	3	....	2	....	....	3	2	16	1	3	1	....	1	....	....	....	2	....	64
Detroit																								
Lockheed	....	....	16	....	3	1	1	1	7	1	5	3	5	....	1	2	11	10	....	1	4	14	....	86
Ryan	3	1	7	3	6	2	4	5	18	4	8	12	10	7	7	4	6	12	6	5	6	20	....	156
Fairchild (new)	4	2	4	2	2	7	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	27
Fokker	....	1	10	5	1	13	3	3	2	....	....	9	1	....	....	....	....	12	6	....	....	18	....	84
Ford	1	....	24	3	1	8	....	3	11	....	....	2	11	2	3	....	3	2	....	1	2	7	....	84
Great Lakes	4	1	8	3	7	....	10	10	6	....	5	1	9	2	5	2	3	1	7	1	6	27	....	118
Lincoln	....	....	1	....	5	....	1	4	2	....	10	3	6	....	4	12	1	2	1	3	....	22	....	77
Mono Aircraft	2	1	15	5	27	5	12	15	13	8	5	9	33	16	19	16	11	6	7	15	7	41	....	288
New Standard	11	4	15	14	6	2	3	1	3	....	....	....	....	2	....	....	....	4	1	....	....	1	2	69
Nicholas-Beazley	5	1	2	....	2	....	5	1	4	1	7	9	4	....	2	3	2	2	1	2	....	9	....	62
Pitcairn	....	....	30	3	9	4	5	5	2	....	....	8	....	....	....	....	....	....	....	....	....	6	....	77
Pitcairn Autogiro	1	....	7	2	6	....	....	2	3	....	....	....	....	....	1	1	....	1	....	....	1	1	....	27
Savoia-Marchetti	....	2	10	....	1	....	2	1	....	....	....	....	1	....	....	....	....	....	....	....	2	....	....	20
Spartan	1	9	3	3	2	2	1	1	2	....	....	1	1	....	3	4	39	8	2	....	....	5	....	87
Stinson	10	6	45	16	27	22	26	29	43	4	20	12	49	8	25	18	11	16	7	14	12	59	7	486
Swallow	1	....	10	3	1	3	4	11	3	3	7	1	14	4	1	15	5	12	4	3	4	17	4	130
United																								
Boeing	1	....	....	....	....	....	....	....	....	....	....	1	18	....	....	....	1	....	2	26	35	21	....	105
Sikorsky	8	1	26	1	....	....	1	3	....	....	1	1	4	1	1	....	....	....	....	....	1	....	3	52
Stearman	2	7	32	3	1	10	....	9	1	1	8	8	5	....	4	6	7	4	1	4	5	49	....	167
Waco	28	31	118	27	60	19	46	91	53	40	42	24	53	44	43	15	10	30	12	15	29	91	1	922
Miscellaneous	25	31	90	31	33	15	18	45	36	11	15	17	59	5	20	25	23	16	6	6	14	116	2	659
Total	223	206	955	210	424	222	357	412	352	142	304	232	496	174	251	273	232	304	151	203	213	936	33	7305

crease of almost 200 per cent in the number of single-seat and two-seat open monoplanes comes from the addition of several hundred Curtiss-Wright Juniors, Bull Pups, and other light planes.

Broadly speaking, light planes now represent about 10 per cent of the total number of licenses outstanding, as against only 2 per cent a year ago.

There has been a sharp drop in the total of really large planes, and the number of those with 15 or more seats, taking all classes together is off from 90 to 61.

Float seaplanes have not been listed separately, as practically all of them are convertible from landplane service. Amphibions remain practically constant in numbers, with a total of 145. Flying boats have suffered a drastic reduction, from a total of 49 to 24.

Local irregularities of distribution are much less marked than in the past. There is evidence here, as in various other investigations made for this issue, that the airplane market is being put onto a more truly national basis. It is still possible, however, to trace some effects of climate, of economic conditions, or of local tastes or prejudices.

Thus, in California the small open machines make up 68 per cent of the total registration. In New York, with a much less favorable climate for year-round flying in the open, they are only 59 per cent, and cabin types are proportionately more important. Climate aside, the proportion of open planes is likely to be high in states with good flying terrain, where a large number of private owners act as their own pilots and where there are relatively few men of great wealth.

Of course in examining these figures for the separate states, it is necessary to reckon in the effect of transport line ownership. Most of the planes belonging to a transport company are usually registered in the state where its home office is located, or in those of its principal repair bases.

Even eliminating that factor, however, certain odd concentrations of ownership still appear. It is still manifest that most of the interest in water flying, aside from its transport employment, is concentrated in little groups of sportsmen around New York and a few other large cities.

Autogiros are presented in the table as a distinct category for the first time, and number 41. As would have been expected, in view of the comparatively recent introduction of the type and of the location around Philadelphia of all the factories that have been selling it during the past year, ownership is very highly concentrated. New York, New Jersey, and Pennsylvania claim just over 60 per cent of the nation's total, and more than 80 per cent are owned east of the Mississippi.

Makes and distribution

THE order of the leading makes of planes, in total numbers of registrations, remains much as in the past. Waco continues in first place, with

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Travel Air second, but if all the Curtiss-Wright products be grouped together their total runs to 1,719, which is well beyond any competition. Stinson has hopped from fifth place in the ranking a year ago to third now.

The most striking feature of the listing of the makes by states of ownership is the absence of national distribution except in a very few instances. It is still true that local pride in a local product, and the actual or supposed advantages of having the factory near at hand for service work, play a very larg part in determining sales. This tendency to concentrate most of the sales within a few hundred miles of the factory seems to be much more marked for open machines than for the cabin type.

Another way of getting at the same information is through an examination of the number of states in which a particular make has made any sort of showing at all. On that basis Travel Air comes closest to showing a truly national distribution, having at least 1 per cent of the total registration in every state except South Carolina, and at least 5 per cent in every state but six. No other make got 1 per cent of the registration in more than 44 states or 5 per cent in more than 40. Three makes, each with more than 250 machines licensed, have 1 per cent representation in less than three-quarters of the total number of states. In other words, they have left more than a quarter of the country practically untouched by their sales campaigns. Curtiss-Wright, Waco, and Stinson are the only makes now in production that are distributed over the entire extent of the country, with at least fair representation in almost every community.

The table of distribution of makes of engines by states that has been included in the statistical issues in past years is omitted this time for want of space. It has, however, been prepared, so that it is possible to give the general conclusions which can be drawn from it.

The most striking feature is the rapid disappearance of the wartime engines. They are going out at an accelerating rate. Two years ago there were 2,900 in service on licensed planes. Last year there were 2,688, and the prophecy was made that the number would have dropped below 2,000 by the end of 1932. It actually went well below that figure in half the time anticipated, for the present breakdown shows it reduced to 1,952. It seems likely now that the wartime engines, and particularly the once ubiquitous OX-5 which makes up 80 per cent of the total of the wartime types in service, will have practically disappeared by the end of 1934.

Excluding the wartime engine from consideration, the Curtiss-Wrights had all other makes in numbers, with a total of 1,910. The J-5 Whirlwind contributes 672 of that total, and the various sizes of J-6 Whirlwinds 764. Kinner is next in line with 665, then Pratt & Whitney with 576.

Licenses and identifications recently granted by makes, quarterly for 1931

	Jan. to Mar.	Apr. to June	July to Sept.	Oct. to Dec.	Total
Aeronca	7	24	20	16	67
American Airp. & Engine	3	5	5	8	21
American Eagle & Eaglet	13	9	13	6	41
Amphibions, Inc.	3	3	2	...	8
Bellanca	6	6	3	5	20
Bird	7	21	16	16	60
Buhl Bull Pup	2	68	23	5	98
Consolidated	5	7	17	7	36
Curtiss-Wright					
Junior	14	144	92	4	254
Kingbird	7	2	1	...	10
Moth	2	1	2	1	6
Robin	5	2	...	...	7
Travel Air Biplane	2	36	12	8	58
Travel Air Monoplane	2	...	1	1	4
Sedan	2	...	11	3	16
Cycloplane	...	...	2	1	3
Detroit Lockheed Vega	6	6	...	...	12
Detroit Lockheed Orion	...	1	5	4	10
Detroit Ryan	...	3	...	...	3
Eaglerock	7	8	5	9	29
Fairchild (new)	1	3	15	19	38
Ford	2	9	3	...	14
General	...	4	2	1	7
Granville	4	1	1	1	7
Great Lakes	18	...	20	...	38
Mono Aircraft	11	12	10	13	46
New Standard	2	2	3	...	7
Nicholas-Beazley	4	10	14	8	36
Pitcairn Autogiro	1	15	27	1	44
Rearwin	...	...	9	5	14
Spartan	6	4	13	...	23
Stinson (4 place)	20	43	35	35	133
Stinson (Airliner)	2	23	11	5	41
Taylor	...	2	12	10	24
United					
Boeing (1 engine)	6	1	3	2	12
Boeing (3 engine)	...	2	...	...	2
Northrop	1	3	5	...	9
Sikorsky (1 engine)	1	2	...	1	4
Sikorsky (2 and 4 engine)	2	1	3	...	6
Stearman	2	7	7	2	18
Waco (open)	19	41	27	14	101
Waco (closed)	...	6	15	11	32
Miscellaneous	110	127	144	92	473
Total	305	664	609	314	1,892

Engines in planes licensed or identified for the first time, quarterly for 1931

	Jan. to Mar.	Apr. to June	July to Sept.	Oct. to Dec.	Total
Aeronca	10	24	22	16	72
American Cirrus	22	3	36	22	83
Continental	4	19	55	35	113
Wright Aeronautical					
Challenger	2	...	9	...	11
Whirlwind (165)	11	7	2	...	20
Whirlwind (240)	4	3	1	5	13
Whirlwind (300)	22	21	14	5	62
Whirlwind (J-5)	2	11	5	...	18
Cyclone (525)	...	4	...	...	4
Gipsy	5	15	5	7	32
Jacobs	2	3	12	4	21
Kinner K-5	19	49	44	12	124
Kinner (others)	...	4	30	10	44
Lambert and Velie	13	15	5	15	48
Leblond	7	6	5	4	22
Lycoming	20	62	46	38	166
Pratt & Whitney					
Wasp	14	26	16	8	64
Wasp, Jr	6	7	3	6	22
Hornet	7	4	10	9	30
Szekely	32	224	137	26	419
Warner	23	42	19	10	94
Ford	6	11	15	10	42
Heath	27	31	35	22	115
OX-5	11	17	21	4	53
Other wartime	5	5	3	1	14
Foreign engines	9	24	23	18	74
Miscellaneous	22	27	36	27	112
Total	305	664	609	314	1,892

Current production by makes

THE table of licenses and identifications issued on new machines is the closest approach that can be offered to a tabulation of production by makes. It has of course certain imperfections as a production record, quite apart from the liability to err in tabulation that always exists. Machines that are shipped directly from the factory for export do not appear in the record. The listing really does not cover the calendar year 1931, but a period extending approximately from Dec. 10, 1930 to the same day of the following year, as there is a certain time lag in reporting licenses. Finally, a few old airplanes are brought out of storage or reimported from time to time, and appear as being newly licensed for the first time. In few cases, if any, should there be a difference of over five or ten planes between the totals reported here and the manufacturer's actual production for the year, and in most instances it is considerably less than that, but the figures must be broadly interpreted and not taken as rigorously representative of the individual production of the several factories, nor as anything else except what they are presented as, a listing of the licenses and identifications newly granted.

If the total of licenses and identifications during the year be taken as the basis of calculation, there appears to be astonishingly little concentration of manufacturing activity in the hands of the largest groups. Of the total number of newly licensed and identified machines, the ten largest companies or groups (counting Curtiss-Wright or United, for example, as one group) accounted for only 56 per cent in the aggregate, exactly the same proportion as 1930.

A great part of the 1,892 machines licensed or identified, however, are in no real sense production, and are quite unrelated to the industry. They are the work of amateurs, building for their own amusement. If all planes in that category be eliminated, the ten largest companies appear as being responsible for 69 per cent of the production that really comes from responsible factories.

Even so, the degree of concentration is much less than in other comparable industries. The ten largest automobile manufacturers account for about 95 per cent of the total production of cars.

The figures on engines used in new planes are not so good a representation of current production as in the case of the planes themselves. Apart from the fact that there is a much larger time lag between the completion of an engine and its appearance on the list of licensed aircraft, a certain number of new machines have old engines installed. Thus, about 1 per cent of the planes of 1931 production were equipped with Wright J-5 engines, which have been out of production for two years. Still the figures offer a fair guide to the production of non-military engines, and they are the best guide that is available for publication.

Only 66 new machines, or 3.5 per cent of the total production, were equipped with wartime engines. For the last quarter the proportion was less than 2 per cent.

Average life expectancy

THE distribution of licensed airplanes by age provides the material for an analysis of their probable length of life. This is the third year in which such a tabulation has been made and we now have the data for a reasonably accurate prediction of the rate at which machines of various types will disappear. At the end of 1929, for example, there were 2,106 machines of 1928 manufacture still carried upon the records. In the course of a year that total dropped to 1,836, and now it has fallen off to 1,383.

To get a real life-expectancy curve, however, the total should be broken down more closely by types. Obviously, there is no reason to suppose that the life of a multi-engined transport machine will be the same as that of a light two-seater.

A group of well-known makes in the low-priced open cockpit class, all of which had at one time a very large production, was selected. The number of machines in that group that were upon the Department of Commerce books at the end of 1929, the end of 1930, and the end of 1931 was determined for each year's production. It develops, for example, that at the end of 1929, 1,343 of the 1928 contingent were in service. During 1930 it dropped to 1,147, and during the past year it has fallen off to 862. Similar comparisons have been made for all the other years' production, and for other groups and types.

It then becomes possible to estimate the rate at which planes of various classes disappear from service.

For the medium-priced open cockpit type it appears that about 4 per cent of the machines are eliminated before the end of the year in which they are produced, and about 7 per cent during the following year. Those figures, of course, represent loss by crash. In the second year following that of production about 12 per cent of the remaining planes disappear, and in succeeding years, up to the sixth year of life, the percentages are 25, 33, and 40. For cabin planes of from three to six-passenger capacity the corresponding percentage rates of elimination for the first six years are 4, 6, 10, 12, 15, and 25. This applies only to the products of responsible companies. "Orphan" planes, and those constructed by amateurs, disappear much more rapidly.

The next step is to determine the average life on the basis of the figure just given. It works out at 3.9 years for the open cockpit types, and 5.0 for the medium-sized cabin machines. These figures for rates of attrition and life expectancy are, on the whole, remarkably close to those derived a year

Licensed airplanes by age and make

	1915-1927 inclusive	1928	1929	1930	1931	Total	Year of manufacture unknown	Grand Total
Aeronca	....	....	3	42	56	101	....	101
Alexander	24	92	97	37	12	262	3	265
Wartime engines	*23*	*77*	*82*	*21*	*1*	*184*	*3*	*187*
Other engines	*1*	*15*	*35*	*16*	*11*	*78*	....	*78*
American Airplane & Engine	18	107	117	30	20	292	14	306
Pilgrime biplane	*6*	*57*	*86*	*23*	*7*	*179*	*4*	*183*
Pilgrim monoplane	*12*	*50*	*31*	*7*	*13*	*113*	*10*	*123*
American Eagle	10	62	79	75	30	256	2	258
Wartime engines	*10*	*59*	*33*	*10*	*3*	*115*	....	*115*
Other engines	....	*3*	*46*	*65*	*27*	*141*	*2*	*143*
Arrow	....	3	53	....	1	57	....	57
Bellanca	1	9	42	24	6	82	....	82
Bird	....	....	58	44	49	151	1	152
Buhl	8	7	7	6	67	95	1	96
Bull Pup	....	....	....	*2*	*67*	*69*	*1*	*70*
Others	*8*	*7*	*7*	*4*	....	*26*	....	*26*
Cessna	....	10	53	7	1	71	....	71
Commandaire	....	26	101	13	....	140	....	140
Wartime engines	....	*26*	*44*	*9*	....	*79*	....	*79*
Other engines	....	....	*57*	*4*	....	*61*	....	*61*
Consolidated	....	4	126	113	30	273	2	275
Fleet (OE)	....	*4*	*124*	*108*	*28*	*264*	*2*	*266*
Commodore (Fb)	....	....	*2*	*4*	....	*6*	....	*6*
Fleetster (CM)	....	....	....	*1*	*2*	*3*	....	*3*
Curtiss Fledgling	....	....	53	....	....	53	....	53
Curtiss Junior	....	....	....	....	211	211	....	211
Curtiss-Keystone	6	5	21	22	....	54	....	54
Curtiss-Moth	1	3	64	35	3	106	2	108
Curtiss (others)	4	6	26	15	13	64	....	64
Curtiss Robin	....	58	361	19	14	452	2	454
Curtiss-Travel Air (biplane)	61	222	298	33	45	659	12	671
Wartime engines	*49*	*185*	*167*	*14*	*1*	*416*	*12*	*428*
Other engines	*12*	*37*	*131*	*19*	*44*	*243*	....	*243*
Curtiss-Travel Air (monoplane)	1	5	75	17	6	104	....	104
Detroit Lockheed	....	8	33	26	18	85	1	86
Detroit Ryan	9	70	56	18	1	154	2	156
Fairchild (new)	....	....	....	....	27	27	....	27
Fokker (single-engined)	2	8	24	6	1	41	2	43
Fokker (multi-engined)	2	7	28	3	....	40	1	41
Ford	3	16	46	7	11	83	1	84
Great Lakes	....	....	48	44	26	118	....	118
Laird	3	6	7	6	2	24	1	25
Lincoln	8	27	22	19	1	77	....	77
Mono Aircraft	....	96	88	76	28	288	....	288
New Standard	....	2	40	23	2	67	2	69
Nicholas-Beazley	....	....	20	15	26	61	1	62
Pitcairn (airplanes)	13	21	29	11	3	77	....	77
Pitcairn (autogiros)	....	....	....	3	24	27	....	27
Savoia-Marchetti	1	....	9	9	1	20	....	20
Spartan	1	13	42	17	13	86	1	87
Stinson	12	48	78	186	161	485	1	486
Single-engined, two and three-place	*1*	*4*	*4*	*2*	....	*11*	....	*11*
Single-engined, four-place	....	*23*	*64*	*168*	*123*	*378*	*1*	*379*
Single-engined, five to eight-place	*11*	*21*	*10*	*7*	....	*49*	....	*49*
Three-engined	....	....	....	*9*	*38*	*47*	....	*47*
Swallow	14	42	63	5	2	126	4	130
United Boeing	24	21	43	16	1	105	....	105
Three-engined	....	*1*	*13*	....	*1*	*15*	....	*15*
Single-engined	*24*	*20*	*30*	*16*	....	*90*	....	*90*
United Sikorsky	....	4	25	18	5	52	....	52
Single-engined	....	....	....	*12*	*2*	*14*	....	*14*
Twin-engined	....	*4*	*25*	*6*	*3*	*38*	....	*38*
United Stearman	3	61	59	25	18	166	1	167
Waco	121	275	247	159	113	915	7	922
Open (wartime engines)	*111*	*233*	*166*	*11*	....	*521*	*4*	*525*
Open (other engines)	*10*	*42*	*81*	*148*	*81*	*362*	*3*	*365*
Closed	....	....	....	....	*32*	*32*	....	*32*
Miscellaneous	34	39	227	159	159	618	16	634
Total	384	1,383	2,868	1,383	1,207	7,225	80	7,305

Wartime engines include Hispano, Liberty, OX5, and OXX6.

ago by a similar process, but with much less data available. The estimates of average life here given exceed those in last year's statistical issue by about 10 per cent. Undoubtedly that apparent increase is in some degree real, due to the improvement in the average quality and durability of the planes. In some degree it is chargeable to the economic stringency, which has made owners of airplanes use them less and maintain them more carefully than they might have done in an era of prosperity, with resultant increase in the useful life of the machines.

From all this it is possible to go on and calculate the replacement demand for the coming year. Roughly speaking, the present total of licensed airplanes is made up of 500 transport machines, which are a very special case treated elsewhere, 500 light planes, 4,500 open-cockpit machines of medium price, and 2,000 cabin planes and open-cockpit sport jobs de luxe. To replace probable elimination during the present year, if every machine crashed, or scrapped, or otherwise removed from the license list were to be replaced by one of the same time, would require 1,140 new cockpit planes, 250 of the cabin planes, and 65 in the light class.

What states take new planes

ON THE whole the map showing relative increases and decreases in numbers of licensed planes during 1931 indicates that the tendencies of the previous year have persisted. Of the fourteen states that increased their number of machines more than 30 per cent during 1930, seven did it again in 1931, along with four newcomers to the list. The steadiest growth is taking place in the Southeast, (especially Florida, Alabama, the Carolinas, and Virginia) in northern New England, and in the Southwest.

On the other hand, the most serious losses are in those prairie states that have been hardest hit by the agricultural depression and in the petroleum district. Kansas, Missouri, and Oklahoma have all shown losses for two consecutive years.

Classification by ownership

FOR the first time since statistical issues began to appear, and so far as is known for the first time anywhere, a complete analysis of the list of licensed planes has been made by types of ownership. It shows the present license in the name of:

Airplane manufacturers	489
Dealers, distributors, and flying services	1,755
Schools	107
Air transport companies	561
Oil companies	73
Other non-aeronautical corporations	138
Flying clubs	175
Individual owners	3,938
Federal government departments	50
State and municipal governments	19

Before any interpretation of these figures is offered, a word of caution must be said. The distinction between individual owners, dealers or flying services, and schools is impossible to make with complete accuracy. A large proportion of the individual owners are actually entering the field of the flying services, either regularly or from time to time. Some of them may be dealers in a small way. We estimate that approximately 50 per cent of the individuals make some commercial use of their airplanes, even though that may not be the major reason for their ownership. That leaves about 2,000 true private owners, using planes only for pleasure or, more frequently, for travel in connection with their personal business of a non-aeronautical nature.

The figure given for schools is obviously very low. It includes only planes licensed in the name of schools which have no other activities, such as the Boeing and Parks institutions. It is probable that at least 750, and perhaps as many as 1,500, of the planes listed under flying service and individual ownership are occasionally used in giving instruction.

How much unsold inventory

A few of the 489 machines listed in the name of their manufacturers are used for business travel by officials of the manufacturing companies, or for the entertainment of visitors, or for testing of accessories or operating methods. A great majority, however (probably about 375 to 400) are actual factory inventory of unsold planes. While an inventory of 25 per cent of the year's production is not nearly as alarming as the corresponding figures of two years ago would have been, it is still much too high. A normal year-end inventory, for the existing rate of production and the existing number of companies, allowing for demonstrators and for machines on which delivery orders have been changed or delivery held up for some other reason, would be about 125.

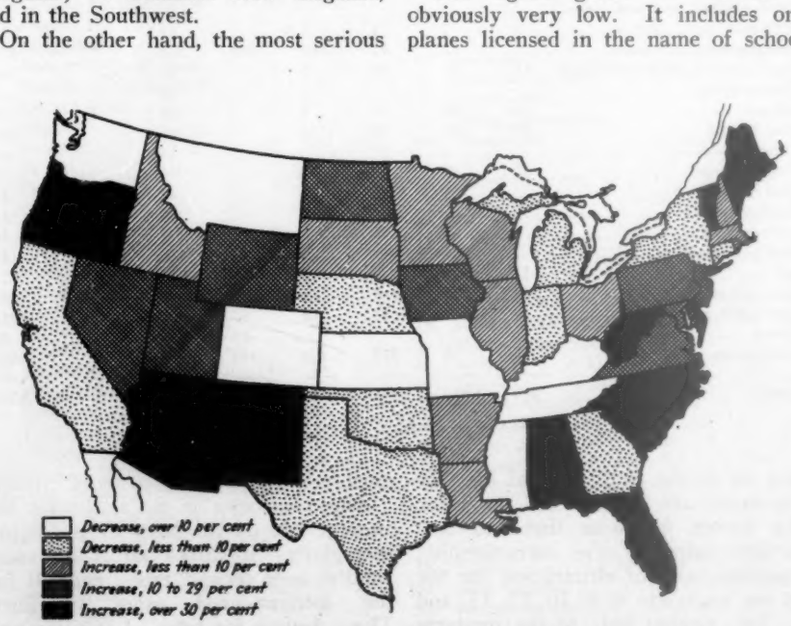
But the 400 machines in the factories do not represent the entire unsold inventory. A certain portion of the 1,755 owned by dealers and flying services are also awaiting disposition.

In that case it is quite impossible to make any close estimate of the distribution between machines in regular service and those simply waiting for a customer. Analysis by make, however, (this table is unpublished) and the classification by type and by age that is printed on page 128, lead us to estimate a further unsold inventory in dealers' hands of about 352 to 400, leaving a balance of about 1,400 for genuine flying service use. The total inventory of planes that have not yet found an ultimate consumer is then around 750, or almost exactly 10 per cent of the total number of machines licensed.

Aside from the question of unsold inventory, the greatest interest of course attaches to the distribution of machines in the hands of transport companies. There may be some surprise at the small total of 561 airplanes. Some other studies of transport ownership, which have been published elsewhere, have indicated a considerably larger figure. It may be that the discrepancy is due to the ownership by some transport companies of schools and flying services, and consequent uncertainty as to the class in which a particular airplane actually belongs. The figure here given is designed to include only machines actually used in regular scheduled transport operations.

What is the life of a transport plane?

A comparison with the table published in last year's statistical issue


Decrease, over 10 per cent
Decrease, less than 10 per cent
Increase, less than 10 per cent
Increase, 10 to 29 per cent
Increase, over 30 per cent

Changes in number of licensed airplanes during 1931 (by states

gives some information on the length of life and rate of replacement of transport equipment. Roughly speaking, the rate of elimination in the first two years of life is between 2 and 5 per cent per year. Thereafter it increases, to about 33 per cent in the fourth year. The average life of transport planes under present conditions would appear to be about 4.4 years. Future experience, however, is likely to indicate a life somewhat shorter than that based on past operating data, since transport planes are constantly being used more intensively. Many of the machines of 1929 manufacture in the possession of the operating companies were flown very little during that year and 1930.

Proceeding to calculate necessary replacements, as was done for other types on page 125, it appears that about 110 new transport machines would be needed during 1932 to replace eliminations. That is 30 less than was predicted in Edward P. Warner's preliminary prophecy for 1932, published in the January issue of AVIATION.

As between large and small transport types, there appears to be no very persistent trend. The 1931 figures, to be sure, show more than 50 per cent of the transport machines put in service to have ten or more seats, as against about 30 per cent in the two previous years, but that is due mostly to the operations of one manufacturer supplying most of his planes to a single group of lines. The place of the open mail plane is obviously decreasing, as is the natural result of the Post Office Department's attitude and of the implications of the Watres Act. More than 40 per cent of the 1928 machines still in transport service are open-cockpit types. For 1929 production the percentage is 29. For 1930 it is 24, and for 1931 only 20. The leading manufacturers represented in transport company ownership are:

Boeing*	85
Stinson	60
Curtiss-Wright (incl. 16 Keystone-Loening amphibions)	58
Fokker	57
Ford	49
Pitcairn	38
American Airplane & Engine	37
Stearman*	31
Lockheed	26
Sikorsky*	24
Miscellaneous	96
*Total for United Aircraft units, 148	561

Oil companies are by far the most important of the non-aeronautical business groups owning and operating planes. In 1929 and 1930 they were very heavy buyers, and of the 73 machines which oil companies now own 59 were built in those two years, only seven in 1931. The non-aeronautical corporations other than oil companies show a total ownership of 138, of which 50 date from 1929, 35 from 1930, and 32 from the year just past.

The distribution of types is shown by a table on the next page. The distribution for the oil companies and for the remainder of the non-aeronautical group is much the same, except that the former have relatively more amphibions than the latter, a slightly larger percentage of open planes, and only one of the seven autogiros. A comparison by make shows the effects of propinquity and of sales effort. A very large proportion of the planes sold to oil companies were built in Kansas or Oklahoma. Most of those for other business operations, on the other hand, come from factories in the neighborhood of New York, Detroit, or Los Angeles. Stinson and Bellanca have made special efforts to sell to miscellaneous manufacturers and to financial institutions, and they are represented by 27 and 10 planes, respectively, owned by companies of those types. Oil company ownership, on the other hand, shows only seven Stimsons and two Bellancas. At the other extreme are Stearman and Spartan, both built in oil territory. Twelve Stearmans and five Spartans are owned by the oil companies, only two of each by other non-aeronautical corporations. Stearman heads the list of oil company employment, while Stinson is first in the other non-aeronautical group. Lockheed, Travel Air, and Sikorsky are very well represented in both types of ownership.

Open-cockpit machines play an overwhelmingly preponderant part among those owned by flying services, making up 64 per cent of the total. Very large machines, which a number of the flying

Planes in use by dealers, distributors, and flying services

	1926 and earlier	1927	1928	1929	1930	1931	Year of manufacture unknown	Total
Landplanes	11	42	274	737	334	290	13	1,701
Light (open)	..	..	..	..	17	169	..	186
Other (open)	10	27	152	451	214	75	9	938
1-3 place (cabin)	..	2	26	124	21	5	..	178
4-6 place (cabin)	1	13	82	129	76	41	3	345
7-9 place (cabin)	..	..	6	27	6	..	1	40
10-14 place (cabin)	..	..	8	5	..	..	..	13
15 place and up (cabin)	..	..	..	1	..	..	..	1
Amphibions and flying boats	1	1	3	9	14	2	1	31
1-3 place	1	..	..	2	2	..	..	5
4-6 place	..	1	1	3	10	..	1	16
7-9 place	..	..	2	2	1	..	..	5
10 place and up	..	..	..	2	1	2	..	5
Autogiros	..	..	..	..	1	10	..	11
Style unknown	2	..	..	5	3	1	1	12
Total planes	14	43	277	751	352	303	15	1,755

Planes in use by transport operators

	1926 and earlier	1927	1928	1929	1930	1931	Year of manufacture unknown	Total
Landplanes	9	34	85	212	55	97	6	498
Open	9	13	40	71	17	20	..	170
1-3 place (cabin)	..	7	7	3	..	7	..	24
4-6 place (cabin)	..	12	20	33	16	3	4	88
7-9 place (cabin)	..	..	7	37	7	12	2	65
10-14 place (cabin)	..	1	11	33	11	54	..	110
15 place and up (cabin)	..	1	..	35	4	1	..	41
Amphibions and flying boats	..	..	6	32	6	2	..	46
1-3 place	..	..	..	1	..	..	..	1
4-6 place	..	..	1	2	1	..	..	4
7-9 place	..	..	2	10	..	..	..	12
10 place and up	..	..	3	19	5	2	..	29
Style unknown	2	..	..	1	1	..	1	5
Total planes	11	34	91	245	71	102	7	561

Planes in use by oil companies and other non-aeronautical corporations

	1926 and earlier	1927	1928	1929	1930	1931	Year of manufacture unknown	Total
Landplanes	1	3	21	82	55	26	3	191
Light (open)	..	..	..	..	..	4	..	4
Other (open)	1	3	10	36	18	5	..	73
1-3 place (cabin)	..	..	3	12	6	..	..	21
4-6 place (cabin)	..	..	6	24	28	15	2	75
7-9 place (cabin)	..	..	1	8	2	2	..	13
10-14 place (cabin)	..	..	1	2	1	..	..	4
15 place and up (cabin)	..	..	..	..	..	..	1	1
Amphibions and flying boats	..	..	..	3	4	3	..	10
Autogiros	..	..	..	..	..	7	..	7
Style unknown	..	..	..	..	..	3	..	3
Total planes	1	3	21	85	59	39	3	211

services were operating two years ago, have now almost disappeared. Of the 201 landplanes of ten-passenger capacity or larger which are now licensed, the dealers and flying services hold only fourteen, while the transport companies have just three-quarters of the total number.

The open plane is still more dominant among the machines owned by flying clubs, making up 92 per cent of the total, including 13 per cent of light planes.

Analysis of the tables of age, type, and ownership shows a general parallelism with the general table on page 125. It has already been noted that the oil companies have done very little buying, but that non-aeronautical corporations of other types, on the other hand, have made relatively heavier purchases in 1930 and 1931 than in 1929. Most strikingly apparent of all, however, is the dependence of the flying services on old equipment. Out of the 1,755 machines in that group, only 37 per cent were manufactured in 1930 or 1931. If reduction be made for the unsold inventory carried by dealers to get the number built in the last two years that are truly in use for flying service work, it comes down to about 300 out of 1,350, or 22 per cent. About 75 per cent of the number of machines now owned by flying services for their own use are of 1929 production.

Aircraft, pilots, and mechanics, as of Jan. 1, 1932

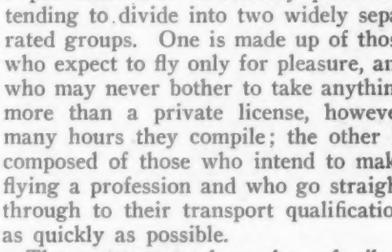
	Aircraft				Pilots				
	Licensed	Unlicensed	Per cent change during year*	Population per plane*	Transport	Ltd. com.	Private	Total	Mechanics
Alabama	36	32	+57	73,507	38	3	68	109	53
Arizona	49	13	+63	8,889	26	6	73	105	41
Arkansas	52	21	+ 2	35,663	39	9	91	140	61
California	959	227	— 4	5,920	1,156	198	1,957	3,327	1,644
Colorado	44	43	—12	23,540	62	18	63	143	80
Connecticut	114	34	— 3	14,095	68	20	93	181	135
Delaware	59	13	+59	4,040	13	2	18	33	20
District of Columbia	85	6	+25	5,728	206	6	60	272	148
Florida	125	76	+45	11,745	143	26	187	357	276
Georgia	39	50	— 3	74,577	55	6	39	100	48
Idaho	20	15	+ 5	22,252	25	5	26	56	24
Illinois	511	223	+ 8	14,933	421	108	596	1,128	549
Indiana	148	124	— 6	21,882	115	38	190	344	145
Iowa	149	73	+21	16,583	97	42	161	300	141
Kansas	145	164	—15	12,972	110	15	95	220	183
Kentucky	39	21	—15	67,041	47	9	59	115	46
Louisiana	89	27	+ 4	22,489	52	9	41	103	67
Maine	44	27	+52	18,123	33	7	15	55	25
Maryland	94	26	+24	17,356	59	22	91	172	104
Massachusetts	207	52	+ 6	20,529	165	51	300	516	199
Michigan	360	161	— 1	13,451	326	78	541	946	441
Minnesota	114	104	+ 4	22,526	127	34	108	269	133
Mississippi	24	16	—22	83,742	22	9	39	70	20
Missouri	229	130	—16	15,849	242	43	162	450	264
Montana	33	28	—23	16,291	34	15	52	101	55
Nebraska	142	71	— 7	9,704	105	24	149	278	121
Nevada	12	6	+20	7,588	6	3	15	25	22
New Hampshire	23	6	0	20,230	11	15	30	56	23
New Jersey	219	113	+11	18,454	181	44	280	506	293
New Mexico	29	7	+61	14,597	22	3	33	58	18
New York	973	254	— 3	12,937	572	186	1,057	1,820	860
North Carolina	75	43	+36	42,270	36	19	52	107	49
North Dakota	43	43	+10	15,834	33	4	33	70	30
Ohio	439	180	+ 8	15,140	409	110	461	980	502
Oklahoma	237	110	— 1	10,109	185	31	197	416	158
Oregon	91	78	+34	10,481	65	16	131	212	107
Pennsylvania	452	104	+10	21,308	283	129	604	1,019	393
Rhode Island	29	9	—12	23,706	17	8	55	80	24
South Carolina	18	30	+38	96,598	18	2	22	42	22
South Dakota	54	20	+ 2	12,830	37	12	57	106	50
Tennessee	69	36	—16	37,921	49	10	95	154	74
Texas	315	143	— 7	18,491	455	47	207	803	393
Utah	31	10	+15	16,382	42	7	17	66	66
Vermont	21	4	+31	17,124	10	5	13	28	14
Virginia	63	25	+26	38,442	143	14	72	229	271
Washington	120	80	—19	13,028	147	49	166	363	188
West Virginia	51	17	+59	33,906	23	7	49	79	29
Wisconsin	182	111	+ 3	16,148	122	45	155	322	103
Wyoming	55	12	+15	4,101	25	5	19	49	67
Alaska	29	5	+107	2,044	22	2	1	26	17
Canal Zone	0	0	....	....	54	3	4	61	70
T. H.	6	1	0	61,389	69	3	20	92	100
Miscellaneous	7	3	....	....	59	4	17	80	50
Totals	7,553	3,227	+ 3	16,255	6,881	1,586	9,226	†17,739	9,016

* Licensed planes only. † Including 46 industrial pilots.

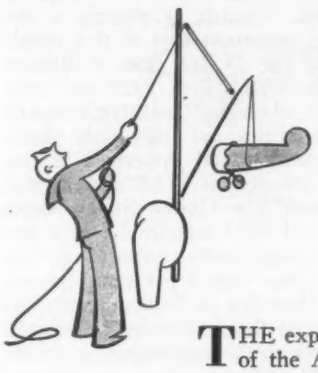
Pilots and their distribution

THE most notable change in the record of pilots in the past year, aside from an increase of 16 per cent in their total number, is a further increase in the proportion of private pilots. Two years ago they were only 41 per cent of the total. Last year they were 49. Now they are 52. The importance of the limited commercial category continues to wane, falling from 14 per cent at the beginning of 1930 to 9 per cent now. Obviously pilots are tending to divide into two widely separated groups. One is made up of those who expect to fly only for pleasure, and who may never bother to take anything more than a private license, however many hours they compile; the other is composed of those who intend to make flying a profession and who go straight through to their transport qualification as quickly as possible.

The greatest total number of pilots are domiciled in California, which indeed runs ahead of any other two states combined, or of any other three except New York. Even if the effect of the large number of Army and Navy pilots located in California be eliminated, it appears that one out of every 2,000 civilian citizens of that state holds a license of some grade.



Design approvals continue, but approved schools diminish in numbers



Foreign trade

"What has America to do with abroad?"

THE export trade of the American aircraft industry, which heretofore showed signs of becoming its mainstay, during 1931 felt the full force of the world-wide economic depression and dropped to the position which it held two years ago. Of the total production of airplanes, aircraft engines, and parts only 12 per cent was sold abroad during 1931 as compared with 17 per cent last year and 11 in 1929. Considering airplanes alone the drop was from 10 per cent exported in 1930 to 6 per cent this year, the figure which obtained in 1929. In the face of a general industrial decline in 1930 the export trade practically held its own, sending to foreign markets barely 6 per cent less than in the peak year of 1929, but during the year just passed the loss was almost 50 per cent of the previous year's figure.

A change almost equally striking, though less depressing, has occurred in the nature of the exports. Airplanes, which in 1930 formed 55 per cent, this year made up only slightly more than a third of the total exports. Aircraft engines and accessories accounted each for another third of the 1931 total, instead of the 19 and 26 per cent which they had formed respectively of the foreign sales of the previous year. Round-the-world, distance and other record flights advertised the efficiency of American engines at a time when aircraft industries in the Soviets, Netherlands and other countries were in the market for such products. That most of these engines were destined for use in transport or military planes is attested by an increase this year in unit value of those exported, as contrasted with a decrease of about a sixth in average unit value of the engines produced in this country. The average unit value of the planes exported, mostly transports and military planes of the higher price-levels, showed a slight decrease, attributable largely to the price reductions typical of the past year.

Europe again our best customer

Among the results of a consideration of the countries of destination of aeronautical exports of the past year is the revelation of Europe as the largest single purchaser of American aircraft products for the first time since 1926. Asia retains second place on the list of buyers, but South America, last year at the top of the list as the destination of more than 35 per cent of our exports, this year drops to fourth place. Revolutions and threats of national bankruptcy have had their effects. The picture of South American purchases of American aeronautical products was confused in the past, especially in 1930, by the inclusion of large numbers of transport planes intended for use on American airlines on the southern continent, licensed in the United States yet listed as exports. The 1931 figure comes nearer to representing true foreign sales. It includes only one large plane, destined for Chile, and is made up almost entirely of engines and parts.

Aeronautical exports

	1929	1930			1931		
	Total Value	Planes No.	Planes Value	Total Value	Planes No.	Planes Value	Total Value
Canada and Newfoundland*	**$1,764,104**	**63**	**$673,776**	**$1,209,260**	**16**	**$63,394**	**$386,473**
Mexico and Central America*	**2,400,402**	**63**	**565,500**	**1,126,804**	**36**	**438,744**	**880,823**
Guatemala	17,200	2	4,032	13,348	4	11,400	18,356
Honduras	29,317	..	.....	60,184	1	15,599	17,147
Mexico	1,851,733	45	445,626	609,015	27	374,745	586,217
Nicaragua	7,368	..	.....	4,241	..	.....	7,500
Panama	316,650	10	73,044	273,717	4	37,000	174,863
Salvador	30,666	..	.....	4,243	..	.....	1,307
Cuba	93,373	5	36,858	116,193	..	.....	42,963
Trinidad and Tobago	.....	3	22,444	41,062	..	.....	26,412
South America	**2,133,086**	**107**	**1,947,150**	**3,115,015**	**12**	**174,551**	**704,787**
Argentina	507,885	20	233,871	464,577	6	51,199	180,859
Brazil	249,094	21	510,234	702,799	1	5,050	151,542
Chile	790,395	17	355,090	692,564	1	58,602	214,889
Colombia	106,863	2	33,350	55,036	4	59,700	80,261
Peru	283,543	45	794,654	1,126,300	..	.....	76,286
Venesuela	17	2	19,951	38,539	..	.....	655
Europe*	**1,431,721**	**11**	**142,861**	**1,287,818**	**20**	**344,288**	**1,503,164**
Belgium	34,660	..	.....	31,878	..	.....	11,844
Czechoslovakia	1,096	..	.....	2,062	1	11,000	14,915
Finland	.....	1	7,496	9,128	..	.....	76,755
France	69,162	..	.....	21,950	1	2,500	10,575
Germany	417,940	..	.....	261,655	1	1,600	27,892
Italy	134,383	1	10,800	44,968	1	21,000	82,807
Netherlands	120,641	..	.....	162,552	3	8,766	265,434
Poland and Dansig	145,355	..	.....	7,787	..	.....	53,706
Rumania	.....	..	.....	19,083	1	1,833	2,176
Soviet Russia in Europe	244,740	..	.....	523,175	..	.....	533,157
Spain	49,793	1	2,790	17,534	4	32,575	33,115
Sweden	9,973	..	.....	18,991	..	.....	40,805
Switzerland	20,360	..	.....	6,622	..	.....	4,666
Turkey in Europe	19,375	..	.....	.....	..	.....	5,252
United Kingdom	147,691	7	123,718	148,818	7	263,512	337,220
Asia*	**1,244,477**	**66**	**1,316,723**	**1,684,810**	**48**	**736,889**	**1,194,935**
British India	.....	1	8,500	9,034	3	7,369	8,504
China	703,829	41	935,472	1,134,646	38	644,170	908,526
Hongkong	15,960	10	71,064	75,683	5	42,600	80,725
Japan	448,056	14	301,687	439,915	..	.....	151,267
Siam	36,501	..	.....	3,321	2	42,750	43,800
Oceania*	**346,345**	**9**	**167,500**	**336,518**	**7**	**51,472**	**131,291**
Australia	19,956	..	.....	3,204	1	25,000	35,143
Java and Madura	67	7	140,000	273,096	..	.....	44,519
New Zealand	13,664	..	.....	472	..	.....	1,189
Philippine Islands	161,120	1	7,500	19,727	6	26,472	50,430
Africa*	**20,834**	**2†**	**6,097†**	**42,410**	**1†**	**4,489†**	**9,246**
Total	**$9,345,606**	**321**	**$4,819,669**	**$8,802,635**	**140**	**$1,812,827**	**$4,810,531**

*Total includes exports to miscellaneous other countries on the continent not included in the breakdown

†Union of South Africa.

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Mexico and Central America, our most important customer at the time of the initiation of air transport systems in those regions in 1929, now occupy third place in the continental grouping.

Canada imports little from U. S.

It is wise, in respect to individual countries, to consider the records for several years in order to neutralize the effect of a few large orders. However, 1931 purchases show too many changes in trend to disregard them entirely. Canada over a three-year period sustains its reputation as our best customer, with Mexico next, also as usual. China, Chile, Peru and Soviet Russia are next in order. According to the 1931 records, however, China is far and away the biggest buyer, Mexico consistently second, while Soviet Russia, whose purchases, of engines and parts only, were larger than ever before, not excluding the early years before a native aircraft industry had been developed, takes third place. Canada is fourth in 1931, with the United Kingdom and the Netherlands, neither of which ranks high on the three-year listing, coming in close succession. The establishment of an aircraft branch by Ford in England is responsible for the increase in exports to England, while the use of American engines in Fokker airplanes of course account for the Dutch total. Again, according to the records of three years, Argentina, Brazil, Japan and Panama made purchases in the order named, but in 1931 Chile had dropped to this second division, and was followed by Argentina, Panama and Brazil.

Australia, New Zealand, and the Philippines though important markets for American automobiles and machinery, made no purchases of any importance to the aeronautical export trade, of which all Oceania accounted for barely 3 per cent. Most of this business was with Java in the Dutch East Indies. Legal restrictions on the licensing of foreign-built planes still make exporting to Australia somewhat difficult.

Trade in dollars
(Thousands omitted)

	1928	1929	1930	1931
Great Britain				
Exports	6,467	10,539	9,962	8,273†
Imports	151	152	....	.....
France				
Exports	5,600	8,412	8,236	5,656‡
Imports	....	130	....	75‡
Italy				
Exports	2,162	1,208	....	.....
Germany				
Exports	1,269	1,682	1,420*	4,394
Imports	....	55	....	.....
Netherlands				
Exports	1,876	2,054	....	.....
Imports	1,018	850	....	.....

* Airplanes only. † Total for eleven months.
‡ Total for ten months.

France and Britain surpass U. S.

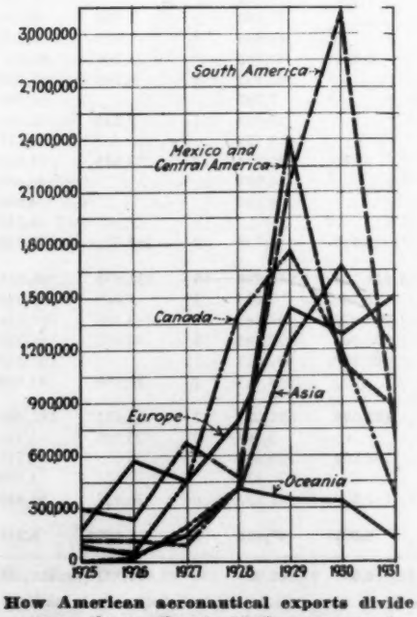
Export and import statistics of European countries for 1931, secured through the Aeronautics Trade Division of the Department of Commerce, though available for the most part only in preliminary form, show a much firmer resistance to world economic conditions than American foreign trade was able to muster. British aeronautical exports, in the past generally averaging about 10 per cent above the American total, in 1931 were almost seven-eighths larger, estimating the totals for the year on the basis of returns for the first eleven months. The British exports were about 10 per cent below those of the preceding year.

Though 1931 figures are not yet available in detail it is probable that more than half this business was with the Dominions, and outlying parts of the British empire, which in 1928 took 43 per cent and in the next two years 52 per cent of the total British exports of aircraft. Canada is playing a decreasingly important part in this trend, accounting for 14 per cent of British exports in 1928, 12 in 1929 and only 6 in 1930, when the Canadian industry with its factories and assembling plants of both British and American manufacturers of aircraft had gotten well under way. The United States which in 1928 and 1929 bought 3 and 7 per cent of the total British exports, in 1930 purchased less than 1 per cent, exports to Latin America in 1930 amounted to 4 per cent of the total instead of the 13 per cent which they accounted for in the two preceding years. Japan and Greece were outstanding markets for the remainder of the British aeronautical exports. British official missions have been useful sales agencies for British aircraft. Most of the sales outside the Empire have been of military craft, though the De Havilland Moth and Puss Moth have played a part by no means negligible.

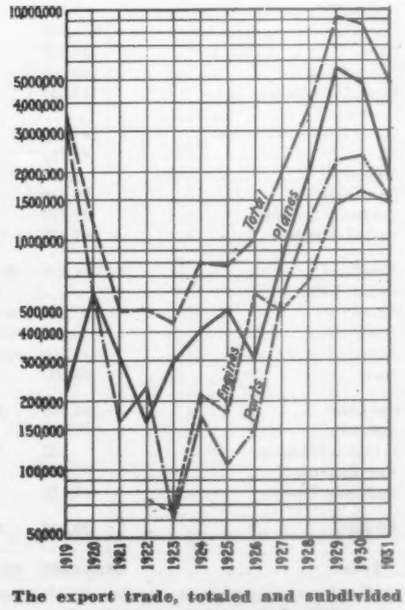
French exports in 1931 were larger than those of the United States for the first time, the ten months' French total exceeding the twelve months' American total by almost 18 per cent. It was largely the result of large orders from Czechoslovakia, the U.S.S.R., and French possessions in Africa and the Far East.

Sweden was the most important customer of the German aeronautical export trade in 1931, with Jugoslavia second, and France, surprisingly enough, next in order, exceeding both Soviet Russia and Greece in both value and quantity of its purchases. Two very expensive experimental machines of very large size made up a great part of the German trade with France.

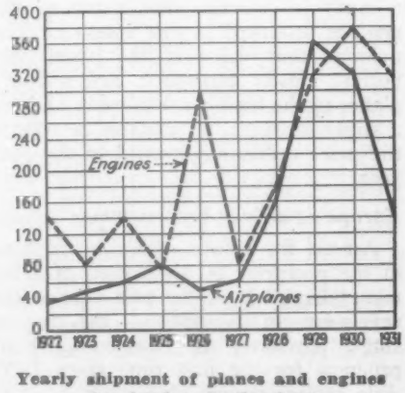
There is no way of making a classification of the exports of any country, with separate figures for civil and military craft. It is probable that for most countries a majority of the aeronautical exports are military. Alliances and financial obligations play a large part in determining the allocation of such orders. In the countries of the eastern hemisphere European nations, and especially France, have a marked political advantage in the military market.



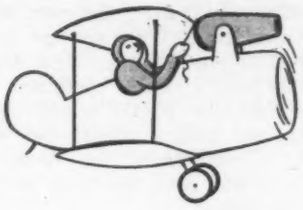
How American aeronautical exports divide among the continents (dollars per year)



The export trade, totaled and subdivided by planes, engines and parts



Yearly shipment of planes and engines for foreign destinations

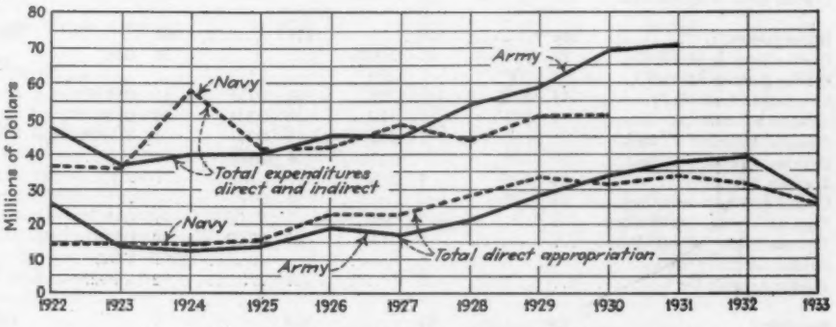


Military and naval

American operations and world standards of air power

THREATENED reductions in appropriations have not yet begun to show their effects on the operations of the Army Air Corps and of naval aviation. Both services made new records, during the past fiscal year, for the amount of flying done. Together, they rolled up some 670,000 hours, with the Army getting about 45 per cent more time than the Navy. Reduced to more comprehensible figures, that means that the average number of service airplanes in the air during the year was about 75 for every minute of the day and night. In per capita terms, it signifies an average flying time of about 190 hours for each pilot in the Regular Army, 160 hours each in the Navy. The Army's total is likely to drop sharply during the next year, as orders issued in the interest of economy will prevent any pilot, except perhaps a few engaged in training, from getting over 220 hours.

Although only very few of the major European countries make any full official report on the amount of flying done in their military services, reasonably reliable estimates can in most cases be made. Thus, it appears probable the Royal Air Force flying time in 1931 totaled about 325,000 hours and that the French air force had somewhere between 250,000 and 400,000. Official reports from Italy show approximately 170,000 for the year for the Italian forces. The Netherlands report 31,500 hours, and Norway, Denmark, and Sweden give 2,600, 4,000, and 15,500 hours respectively.



Aeronautical expenditures, Army and Navy

As would have been anticipated in view of the growing importance of the arm, aviation has been receiving a gradually increasing share of the total national defense budget. Aeronautical expenditures, direct and indirect, have climbed from less than 10 per cent of the total defense outlay just after the war to 17 per cent in the last year for which figures are available. (The 1930 figure read off the curve differs somewhat from that given in the table on page 134. The discrepancy is due to a difference in the definition of "indirect expenditure," that in the table having been modified to accord with the League of Nations standard and so make the American totals and percentages directly comparable with those for other countries.) Direct expenditures alone rose from a post-war 4.8 per cent to a high of 10.2 last year. Now, unhappily, the trail is being reversed. Not only the absolute appropriations, but the proportion of all military expenditure that goes for aeronautical purposes, is being reduced. In the next fiscal year, as the figures now appear, aviation's share of the defense budget will be only one per cent higher than at the time when the Morrow Board met.

The total number of airplanes in the naval service remains stabilized close to the one thousand provided by the five-year program of 1926. The Army's total is 25 per cent below the 1,800 for which its 1926 program called, has increased hardly at all during the past year, and is in fact below the lowest figure that was reached from 1918 to 1925. At that time, of course, great numbers of Liberty-engined DH4's were still on the roster.

Military and naval aviation

	Army				Navy			
	1930	1931	1932	1933[1]	1930	1931	1932	1933[1]
Appropriations—direct, total (incl. salaries of civil personnel)	$33,713*	$38,043	$29,528	$25,810	$32,913*	$32,033	$31,135	$25,750
Appropriations—new planes and engines	$17,242*	$15,843	$15,296	$11,282	$14,215*	$13,033	$11,500	$5,800
Total personnel at end of fiscal year:								
Officers	1,266	1,286	.....	.....	1,019	1,436	.....	.....
Enlisted men	12,086	13,190	.....	.....	10,769	13,671	.....	.....
Flying personnel at end of fiscal year	1,133	1,256	1,477[1]	.....	964	1,198	.....	.....
Officer pilots, total	1,113	1,225	.....	.....	696	835	.....	.....
Naval	.....	.....	.....	.....	614	737	.....	.....
Marine Corps	.....	.....	.....	.....	82	98	.....	.....
Enlisted pilots, total	20	31	.....	.....	268	363	.....	.....
Naval	.....	.....	.....	.....	244	330	.....	.....
Marine Corps	.....	.....	.....	.....	24	33	.....	.....
Students graduated from flying schools during year	306	247	.....	.....	234	258	.....	.....
Number of planes on hand[2]	1,319	1,328	.....	.....	1,081	980	.....	.....
Flying hours during fiscal year	325,273	396,961	.....	.....	264,788	272,455	.....	.....
Reserve officers enrolled and qualified as pilots	1,845	1,786	.....	.....	.....	.....	.....	.....
Reserve officers doing periods of active duty during year	1,415	1,232	.....	.....	.....	353	.....	.....

*Thousands omitted. [1]Estimates. [2]Actual date for these figures ranges from July 1 to Dec. 31, usually Oct. 1. Both figures include reserve planes.

Procurement of aircraft, U. S. Army Air Corps

	1928		1929		1930		1931		
Contractor	No.	Desig.	No.	Desig.	No.	Desig.	No.	Desig.	Total
Pursuit	**16**	.....	**64**	.....	**59**	.....	**180**	.....	**319**
Boeing Airplane Company	16	PW9D	9	P12	59	P12B	131	P12C	250
Boeing Airplane Company	...	.....	1	XP12	...	.....	34	P12E	
B. J. Aircraft Corp	...	.....	...	.....	...	.....	15	Y1P	15
Curtiss Aero. & Motor Co.	...	.....	33	P1C	...	.....	...	.....	54
Curtiss Aero. & Motor Co.	...	.....	18	P6	...	.....	...	.....	
Curtiss Aero. & Motor Co.	...	.....	3	P11	...	.....	...	.....	
Attack	**36**	.....	...	.....	**79**	.....	...	.....	**115**
Curtiss Aero. & Motor Co.	36	A3	...	.....	78	A3B	...	.....	115
Curtiss Aero. & Motor Co.	...	.....	...	.....	1	XA8	...	.....	
Observation	**131**	.....	**176**	.....	**171**	.....	**204**	.....	**682**
Curtiss Aero. & Motor Co.	21	O11	41	O1E26	...	.....	30	O1G	92
Curtiss Aero. & Motor Co.	...	.....	...	.....	...	.....	...	.....	
Douglas Aircraft Co., Inc.	71	O2H	60	O2K	53	O25A	33	O38	364
Douglas Aircraft Co., Inc.	1	O2J	61	O2H	30	O32A	30	O38B	
Douglas Aircraft Co., Inc.	...	.....	3	O22	13	O38	5	YO31A	
Douglas Aircraft Co., Inc.	...	.....	...	.....	4	Misc.	...	.....	
Loening Aircraft	10	O1C	8	OA2	...	.....	...	.....	18
Consolidated Aircraft Corp.	28	O17	...	.....	1	O17	...	.....	29
Thomas-Morse Aircraft Corp.	...	.....	1	O23	1	Y1O33	71	O19C	174
Thomas-Morse Aircraft Corp.	...	.....	2	O19	69	O19B	30	O19E	
Fokker Aircraft Corp	...	.....	...	.....	...	.....	3	YO27	5
Fokker Aircraft Corp	...	.....	...	.....	...	.....	2	Y1O27	
Bombing	**35**	.....	**37**	.....	**73**	.....	**7**	.....	**152**
Curtiss Aero. & Motor Co.	2	B2	10	B2	...	.....	...	.....	12
Keystone Aircraft Corp.	25	LB5A	27	LB6,7	63	LB10A	...	.....	133
Keystone Aircraft Corp.	8	LB7	...	.....	7	LB13	...	.....	
Keystone Aircraft Corp.	...	.....	...	.....	3	LB14	...	.....	
Fokker Aircraft Corp.	...	.....	...	.....	...	.....	3	YB8	7
Fokker Aircraft Corp.	...	.....	...	.....	...	.....	4	Y1B8	
Cargo and miscellaneous	**10**	.....	**17**	.....	**18**	.....	**39**	.....	**84**
Ford Motor Company	...	.....	8	C3A	...	.....	4	C4A	12
Fokker Aircraft Corp.	10	C2A	6	C7A	...	.....	20	Y1C14	37
Fokker Aircraft Corp.	...	.....	1	F10A	...	.....	...	.....	
Sikorsky Aircraft Corp.	...	.....	1	CA6	10	C6A	...	.....	11
Fairchild Airplane Mfg. Co.	...	.....	1	FC2	8	YF1	6	F1A	15
Consolidated Aircraft Corp.	...	.....	...	.....	...	.....	1	Y1C11	4
Consolidated Aircraft Corp.	...	.....	...	.....	...	.....	3	Y1C22	
Detroit Aircraft Corp.	...	.....	...	.....	...	.....	1	Y1C12	2
Detroit Aircraft Corp.	...	.....	...	.....	...	.....	1	Y1C17	
Northrop Aircraft Corp.	...	.....	...	.....	...	.....	1	YC19	3
Northrop Aircraft Corp.	...	.....	...	.....	...	.....	2	Y1C19	
Training	**161**	.....	**120**	.....	**16**	.....	**178**	.....	**475**
Consolidated Aircraft Corp.	130	PT3	120	PT3A	16	XPT6	4	X1PT11	270
Curtiss Aero. & Motor Co.	31	AT5A	...	.....	...	.....	...	.....	31
Douglas Aircraft Co., Inc.	...	.....	...	.....	...	.....	146	BT2B	166
Douglas Aircraft Co., Inc.	...	.....	...	.....	...	.....	20	BT2C	
Stearman Aircraft Co.	...	.....	...	.....	...	.....	1	6A	4
Stearman Aircraft Co.	...	.....	...	.....	...	.....	3	YPT9	
Verville Aircraft Co.	...	.....	...	.....	...	.....	4	YPT10	4
Total	**389**	.....	**415**	.....	**418**	.....	**608**	.....	***1,830**

Procurement of aircraft engines, U. S. Army Air Corps

	1928		1929		1930		1931		
Contractor	No.	Desig.	No.	Desig.	No.	Desig.	No.	Desig.	Total
Air-cooled	**402**	.....	**498**	.....	**712**	.....	**1143**	.....	**2755**
Wright Aeronautical Corp.	200	J5A	164	R790A	...	.....	16	R540	879
Wright Aeronautical Corp.	110	J5B	126	R975A	...	.....	...	.....	
Wright Aeronautical Corp.	57	R790A	68	Cyclone	...	.....	95	R1750	
Wright Aeronautical Corp.	3	R760	...	.....	...	.....	40	R1820	
Pratt & Whitney	32	Hornet	100	R1340	3	Wasp Jr.	486	R1340	1850
Pratt & Whitney	...	.....	40	Hornet	358	R1340	434	SR1340	
Pratt & Whitney	...	.....	...	.....	264	R1690	60	R1690	
Pratt & Whitney	...	.....	...	.....	73	R1750E	...	.....	
Kinner Airplane & Eng. Co.	...	.....	...	.....	14	K5	...	.....	14
Continental Aircraft Eng. Co.	...	.....	...	.....	...	.....	12	YR540	12
Liquid-cooled	**6**	.....	**256**	.....	**362**	.....	**157**	.....	**781**
Wright Aeronautical Corp.	2	V1550	157	D12	168	D12	60	V1150	781
Wright Aeronautical Corp.	4	V1460	12	V1460	194	V1570	97	V1570	
Wright Aeronautical Corp.	...	.....	36	GV1570	...	.....	...	.....	
Wright Aeronautical Corp.	...	.....	47	V1570	...	.....	...	.....	
Wright Aeronautical Corp.	...	.....	4	XV1570	...	.....	...	.....	
Total	**408**	.....	**754**	.....	**1074**	.....	**1300**	.....	***3536**

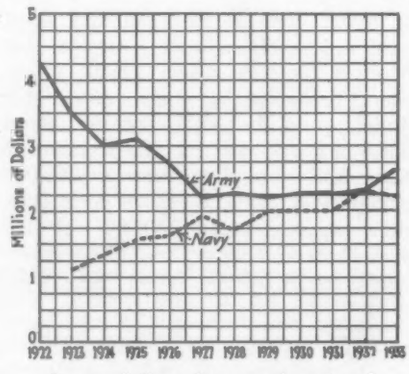
*Miscellaneous experimental orders included in totals, but not listed separately.

Both the Army and Navy continue to set up safety records of unparalleled excellence. During the past year, for the first time, both services averaged less than one fatal accident for every 10,000 hours. Their combined average was 0.64 per 10,000 hours, or 15,600 hours per fatal accident. For the first time in six years, the Army had a distinct lead over the Navy in the matter of safety.

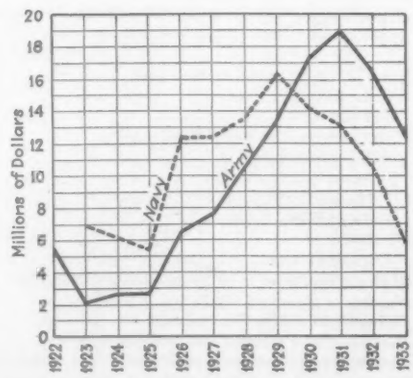
On this point, as on flying hours, most air forces are very chary of giving out statistics. There probably is no great European or Asiatic Power that can claim a higher quality of flying equipment or flying personnel, or that conducts its air operations with greater efficiency, than Great Britain. During the year just ended the Royal Air Force had 43 fatal accidents, indicating, on the strength of the flying-time estimate already made, a fatality rate of 1.3. The French, Italian, and Japanese rates almost certainly exceed 2.0, though the data at hand are not sufficiently complete to justify separate estimates for those countries.

The air forces of the world

IT IS extremely difficult to make any comparative estimates of air power, but it is not quite so difficult as it was a year ago. In preparation for the Disarmament Conference at Geneva, all the great nations and most of the small ones have released an unprecedented amount of information on their military establishments, including aircraft. It is



Appropriations for experiment and development



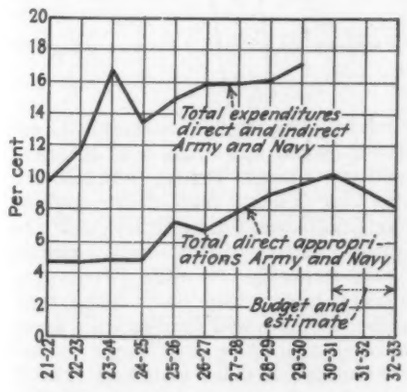
Money for new planes and engines

still true that no other country gives quite such complete figures as are published annually by the United States War and Navy Departments, but at least we have the material now for a general summary under certain headings—even though in some cases it must be more or less approximate.

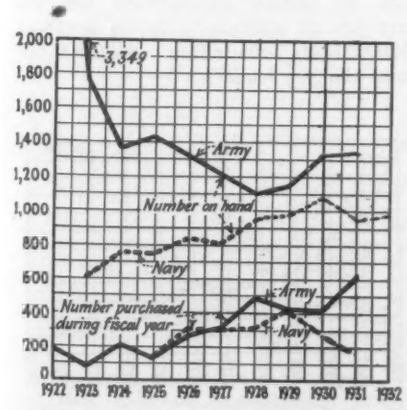
Of course the Disarmament Conference has not been the only source for this tabulation. Some fifteen countries furnished data directly on request. European aeronautical periodicals have been drawn upon to advantage. A survey prepared by Howard Mingos and published by Carl Byoir & Associates has been extremely helpful. Many gaps have been filled, and apparent discrepancies have been smoothed out, with the aid of AVIATION's foreign correspondents and with data drawn from other unofficial sources.

The finished table speaks for itself. It speaks, among other things, of some marked differences in organization and allocation of equipment among the major Powers. No other country, for example, lists so many airplanes of military types as being assigned to training and administrative functions as does the United States. No other country, on the other hand, has such a preposterously small reserve of equipment. It is the general rule elsewhere for each squadron to keep with it, immediately available, an immediate reserve of from 30 to 50 per cent.

It seems to be the almost invariable rule, holding for all the leading Powers



Aviation's share of total war budget



Planes on hand and new purchases

Procurement of aircraft, U. S. Navy

Contractor	1928 No.	1928 Desig.	1929 No.	1929 Desig.	1930 No.	1930 Desig.	1931 No.	1931 Desig.	Total
Fighter (F)	**124**	.....	**68**	.....	**102**	.....	**34**	.....	**328**
Boeing Airplane Co.	30	F2B	29	F4B	46	F4B	30	F4B	210
Boeing Airplane Co.	73	F3B	...	.....	1	XF5B	1	XF6B	
Curtiss Aero & Motor Co.	1	F7C	37	F8C	52	F8C	1	XF8C	112
Curtiss Aero & Motor Co.	20	F8C	...	.....	1	XF9C	...	.....	
Observation	**178**	.....	**181**	.....	**54**	.....	**71**	.....	**484**
Chance Vought Corp.	151	O2U	159	O2U	36	O3O	65	O3U	412
Chance Vought Corp.	...	.....	...	.....	1	XO4O	...	.....	
Loening Aero. Eng. Co.	20	OL8	20	OL8	2	XO2L	...	.....	
Loening Aero. Eng. Co.	...	.....	...	.....	15	OL9	...	.....	57
Curtiss Aero & Motor Co.	7	OC2	...	.....	...	.....	3	O2C	10
Patrol (P)	**3**	.....	**48**	.....	**54**	.....	**2**	.....	**105**
Glenn L. Martin Co.	...	.....	30	PM1	25	PM2	...	.....	
Glenn L. Martin Co.	...	.....	1	XP2M	...	.....	...	.....	65
Glenn L. Martin Co.	...	.....	9	P3M	...	.....	...	.....	
Keystone Aircraft Corp.	...	.....	...	.....	18	PK1	...	.....	18
Naval Aircraft Factory	1	PN12	...	.....	...	.....	...	.....	2
Naval Aircraft Factory	1	PN11	...	.....	...	.....	...	.....	
Hall Aluminum Aircraft	...	.....	...	.....	9	PH1	...	.....	10
Hall Aluminum Aircraft	...	.....	...	.....	1	XP2H	...	.....	
Consolidated Aircraft Corp.	...	.....	...	.....	...	.....	1	XP2Y	1
Sikorsky Aircraft Corp.	1	XPS1	2	PS2	1	XP2S	1	XS8	9
Sikorsky Aircraft Corp.	...	.....	4	PS3	...	.....	...	.....	
Torpedo bombers (T) (B)	**110**	.....	**19**	.....	**20**	.....	**45**	.....	**194**
Douglas Aircraft Co.	8	T2D	...	.....	18	T2D	...	.....	27
Douglas Aircraft Co.	...	.....	...	.....	1	XT3D	...	.....	
Glenn L. Martin Co.	102	T4M	1	XT6M	...	.....	12	BM1	115
Detroit Aircraft Co.	...	.....	...	.....	...	.....	32	TG2	32
Great Lakes Aircraft Corp.	...	.....	18	TG1	...	.....	...	.....	18
Trainers (N)	**13**	.....	**103**	.....	**52**	.....	...	.....	**168**
Consolidated Aircraft Corp.	7	NY2	86	NY2	20	NY3	...	.....	123
Consolidated Aircraft Corp.	3	XN2C	1	XN3Y	6	N2Y	...	.....	
New Standard Aircraft Co.	...	.....	...	.....	6	NT1	...	.....	6
Curtiss Aero & Motor Co.	...	.....	...	.....	20	N2C	...	.....	20
Keystone Aircraft Co.	2	XNK	16	NK1	...	.....	...	.....	18
Transport (R)	**3**	.....	**4**	.....	**2**	.....	**8**	.....	**17**
Ford Airplane Co.	...	.....	3	JR2-3	2	JR3	1	RR4	6
Fokker Aircraft Corp.	3	TA2	1	TA2	...	.....	1	RA4	5
Sikorsky Aviation Corp.	...	.....	...	.....	...	.....	3	RS1-3	3
Scout (S)	...	.....	...	.....	**1**	.....	**3**	.....	**4**
Miscellaneous	**1**	.....	**2**	.....	**2**	.....	**1**	.....	**6**
Total	**432**	.....	**423**	.....	**257**	.....	**164**	.....	***1306**

Procurement of aircraft engines, U. S. Navy

Contractor	1928 No.	1928 Desig.	1929 No.	1929 Desig.	1930 No.	1930 Desig.	1931 No.	1931 Desig.	Total
Air-cooled	**732**	.....	**900**	.....	**544**	.....	**240**	.....	**2416**
Wright Aeronautical Corp.	81	J5	3	R760	50	R760	5	R975	1121
Wright Aeronautical Corp.	138	R790	161	R790	3	R975	4	R975E	
Wright Aeronautical Corp.	45	R1750	3	R540	2	R1510	14	R760	
Wright Aeronautical Corp.	32	R1750A	24	R975	345	R1820E	73	R1820E	
Wright Aeronautical Corp.	1	R1200	132	R1750	...	.....	2	V12	
Wright Aeronautical Corp.	...	.....	3	R1920	...	.....	...	.....	
Pratt & Whitney	39	R1300	526	R1340	4	R985	4	R985	1260
Pratt & Whitney	83	R1700	36	R1690	115	R1340	98	R1340	
Pratt & Whitney	274	R1340B	7	R1860	3	R1860	2	R1535	
Pratt & Whitney	37	R1690	...	.....	...	.....	20	R1690	
Pratt & Whitney	...	.....	...	.....	...	.....	12	R1860	
Kinner Aero & Motor Co.	...	.....	...	.....	18	R370	...	.....	18
Liquid-cooled	**49**	.....	...	.....	**5**	.....	**16**	.....	**70**
Curtiss Aero & Motor Co.	...	.....	...	.....	2	V1110	8	GV1570	10
Curtiss Aero & Motor Co.	...	.....	...	.....	...	.....	1	V1570	1
Packard Motor Car Co.	48	3A2500	...	.....	...	.....	...	.....	48
Maybach Motor Co.	1	VL2	...	.....	2	VL2	4	VL2	7
Total	**781**	.....	**900**	.....	**549**	.....	**256**	.....	***2486**

*Miscellaneous experimental orders included in totals, but not listed separately.

Military appropriations, personnel, and aircraft

	Distribution of appropriation Dollars (000 omitted)			Per cent of total defense appropriation	Personnel			First line aircraft				Reserve and misc. planes[5]	Training planes	Total
	Total	Material[1]	Pay		Officers	Enlisted men	Total	Home squadrons	Overseas squadrons	Shipboard	In use for training			
North America														
Canada	3,409	721	1,750	17.7	85	365	450	46	...	...	....	40	80	166
U. S. A.	109,066	29,596[2]	31,334	15.2	2,290	25,000	27,300	527	82	220	923	49	765	2,566
South America														
Argentina	3,804	566	865	....	146	800	946	48	...	...	....	....	...	82
Europe														
Belgium	.....	.....	.....	....	....	.....	2,840	106	...	...	....	89	113	308
Czechoslovakia	.....	.....	.....	....	396	6,100	6,482	....	...	...	....	....	141	687
Denmark	756	436	181	6.3	....	.....	237	....	...	...	....	....	...	78
Esthonia	.....	.....	.....	....	....	.....	467	....	...	...	....	....	...	74
Finland	750	.....	.....	....	213	1,697	1,910	....	...	...	....	....	...	....
France	83,600	21,200[2]	18,200	15.5	3,781	35,506	39,287	1,210	395	62	708	2,500	300	4,675
Great Britain†	98,500	31,700[2]	22,200	17.8	3,450	28,770	32,220	480	252	153	375	780	497	2,540
Greece	.....	.....	.....	....	....	.....	2,379	54	...	...	....	....	...	160
Italy	50,000	10,800[3]	9,000	15.1	2,215	21,189	23,404	600	...	50	250	500	200	1,600
Irish Free State	380	131	141	6.2	....	.....	163	15	...	...	....	....	9	24
Jugoslavia	4,160	2,030	564	11.0	....	.....	10,810	309	...	...	....	....	297	924
Latvia	.....	.....	.....	....	....	.....	550	....	...	...	....	....	...	79
Lithuania	386	173	144	6.8	84	645	729	....	...	...	....	....	...	....
Netherlands	4,500	718[2]	1,280	6.4	143[4]	.....	1,497	110	100	...	....	48	61	321
Norway	1,170	612	308	9.5	....	.....	360	....	...	...	....	....	...	140
Poland	8,750	4,250	1,475	9.2	661	7,258	7,919	....	...	...	....	....	...	700
Portugal	483	25	281	3.3	....	.....	997	....	...	...	....	....	...	153
Roumania	8,850	5,400	1,800	14.6	....	.....	11,836	....	...	...	....	....	...	799
Spain	4,000	.....	.....	....	....	.....	5,389	246	108	...	134	53	...	650
Sweden	2,450	1,220[2]	343	7.0	....	.....	991	91	...	...	....	....	76	167
Switzerland	1,320	640	485	6.1	....	.....	258	125	...	...	....	....	175	300
U. S. S. R.	20,000[6]	.....	.....	....	2,310	17,240	19,550	....	...	...	....	....	....	2,000
Asia														
Siam	2,100	1,320	341	17.7	98	2,388	2,486	189	...	...	....	....	155	344
Japan	36,400	.....	.....	....	1,457	12,851	14,308	250	...	100	350	350	300	1,350
Africa														
Egypt	243	94	59	5.1	6	.....	.....	....	...	...	....	....	...	5
S. A. Union	658	86	45	15.5	....	.....	305	30	...	...	....	8	28	66
Oceania														
Australia	2,600	685	1,420	11.3	....	.....	915	12	...	...	16	24	20	72
Dutch E. Indies	776	234	472	....	28[4]	.....	.....	....	...	...	....	....	18	77

† Including India. [1] Except where otherwise noted, includes all materials, of which one-half to one-third is for airplanes and engines. [2] Airplanes and engines only. [4] Pilots only. [5] Including immediate reserves. [6] See footnote 3 on page 136. Figures for 1930 and 1931.

with astonishing uniformity, that one-third of all the planes, including training machines, that are owned by the military services of a country are organized into first-line tactical units.

Except for the great powers, the figures furnished the League of Nations have been the major dependence. It is suspected, however, that some of the smaller European countries have overstated the facts in order to start the reduction of their arms from an advantageous position. In particular, Jugoslavia and Roumanian airplane totals are probably on the high side. That may be also true of Japan.

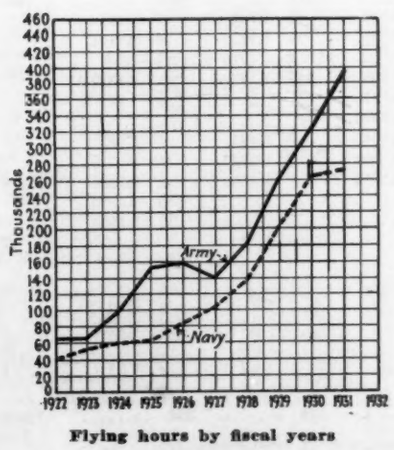
Comparison of the figures of course shows France an easy first, by any standard. On total air strength, Great Britain would appear to hold the next position (though British officials are wont to lament that their country stands no better than fourth), with the United States third, Italy fourth, Russia probably in fifth place, and Japan a fairly close sixth. The total number of the world's military airplanes (excluding training machines) is approximately 18,000, including 12,800 from the six great air powers. The total of annual expenditure for the purposes of military aviation is about $500,000,000, including $420,000,000 from the six leaders.

Fatal accidents per 10,000 flying hours

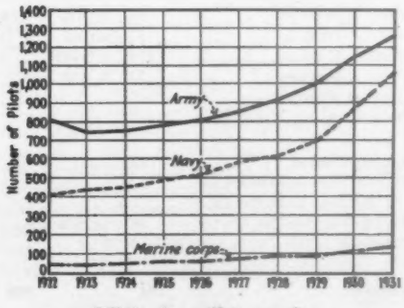
American services (fiscal years)

	1928	1929	1930	1931	1932*
Army	1.37	1.59	1.14	0.53	....
Navy	1.38	0.89	0.53	0.77	0.65

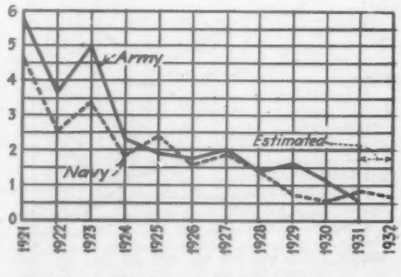
*First six months only.



Flying hours by fiscal years



Pilots in active service

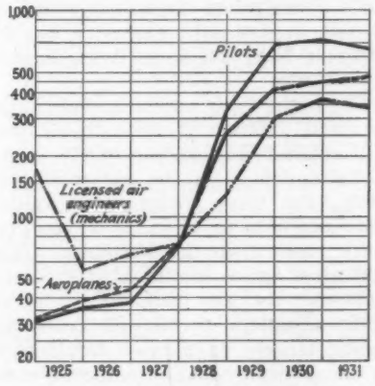


Fatal accidents per 10,000 flying hours

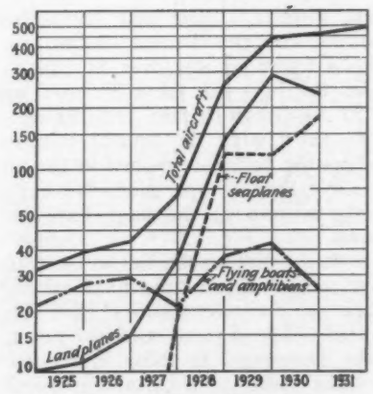
Canadian aviation

Little change in 1931

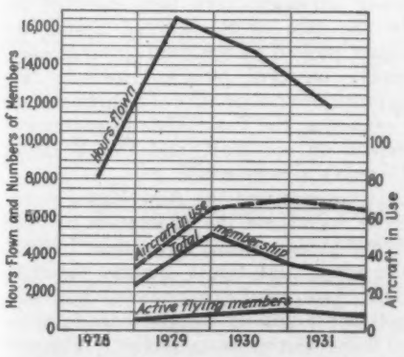
CANADIAN aviation in general held up well in 1931, despite the need for retrenchment. Transport planes flew an increased mileage, with passenger mileage practically the same as in 1930. The route mileage of the mail services dropped during the year, of course, as a result of the eliminations made during the summer for reasons of economy, but the volume of mail exceeded that for 1930. Three-quarters of all the passenger traffic, together with nearly half the mail, was handled on the Winnipeg-Pembina and Mackenzie River lines. The route from Moncton to Charlottetown, on Prince Edward Island, showed exceptionally good progress in 1930.



Pilots, mechanics, machines



Float seaplanes increase their proportion of licensed total



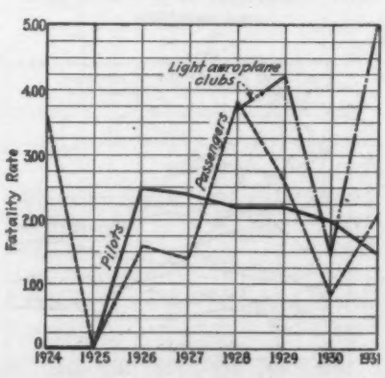
Canadian subsidized light airplane club activities—membership, aircraft, and hours flown

Less favorable reports come from the 23 recognized flying clubs. Their records show a slight drop in every curve except that representing the fatality rate, which rose alarmingly. This is all the more disturbing since the fatality rate for all civil pilots decreased, continuing a trend downward continuously since 1926. The fatality rate for passengers in civil aircraft rose to about 60 per cent of the figure for 1929, more than double the 1930 record.

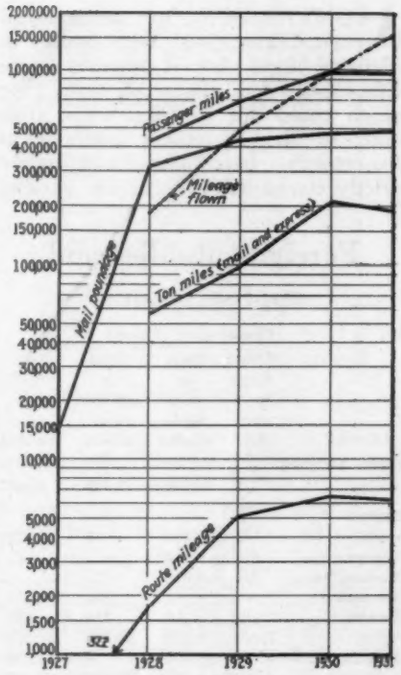
Only four clubs showed an increase in hours flown last year, and the average hours per club plane dropped from about 200 in 1930 to 184 in 1931. Two clubs disappeared from the roster, one remained but did no flying, and two were added. Total flying time is off 30 per cent from the 1929 high. Leading clubs, in amount of activity, were Edmonton, Toronto, Montreal, and the border cities.

Some of the clubs appear to have a considerable membership joining for social reasons only. In Saskatoon, for example, the flying time was nine hours for each member qualified to solo.

American designed planes (many of them built or assembled in Canada by licensees) total 261, more than half of all the civil aircraft registered in the Dominion. Leading makes are 39 Fairchilds and 27 Fokkers, mostly Super-Universals. De Havilland Moths lead all the rest, 148 of the 215 machines of British design being of that make. Among the balance are 33 planes of original Canadian types, twenty French machines and seven Junkers. Twenty machines of war-time design, most of them HS boats, are still listed as in service. Canadian production for 1931, including that of the licensees of American and British firms, was about 60 planes.



Accident rates per 1,000,000 passenger-miles, and (for clubs) per 10,000 hours



Contract air mail operations

In Canada, as in the United States, the number of aircraft in service remained virtually static in 1930 and increased about ten per cent in 1931. Their is an apparent tendency to abandon the flying boat in favor of the float seaplane, a natural outgrowth of the popularity of the Moth and of the Fairchild and other American types. There has been an actual drop of about ten per cent in the number of licensed pilots in the Dominion during the past year, as against an increase of 15 per cent in the United States.

Foreign activities

How do Europe and America compare?

A COMPARISON of aeronautical expenditures has been made in tabulated form, but it requires some little explanation. There are many gaps which could not be filled even after study of all the records available in this country. It is impossible to secure strictly comparable figures for parallel listing for the various countries. The definition of the term "subsidy" varies from place to place. Still more variable is the determination of what should be included within the appropriations for civil aeronautics. In France, and in a number of other countries to a lesser extent, there are general services which have both civil and military functions and which can not be split up between the two.

In general, the attempt has been to include charges for the regulation of aircraft, for airway development, and for research bearing exclusively on civil employment of aviation. In short, the items have been set as nearly as possible in parallel form with those of the budget of the Aeronautics Branch of the Department of Commerce. It is not always possible to make such a separation, however, and in some cases meteorological services and other auxiliary expenditures are included. Very special cases are those of Germany and Austria, which are prohibited by treaty from having any military air force, and which must, therefore, charge all their aeronautical expenditures to the civil division. In Germany a large amount of miscellaneous research, developmental, and administrative work that would be carried in any other country by the Army or Navy has to go down as civil expenditure.

The highest per capita appropriation for civil aviation is undoubtedly that of Canada. Taking into account the probable deficit on the air mail contracts, the total governmental outlay there amounts to 65 cents a year for every resident in the Dominion. The equivalent figure for the United States, including the air mail deficit, is 25 cents. Belgium spends 30 cents per capita, largely on airway development in the African colonies, while no other European state goes as high as 25.

The standing on total per capita expenditures, including the military, is quite different. On that basis, both Canada and the United States, each with a figure of just over $1, are well down the list—far below France. with $2.50, or Great Britain, with $2.25.

To show what the several countries are getting for their money in the way of air transport operation, the curves at the bottom of the page have been drawn.

Both the direct subsidies to the transport companies and the total expenditures on civil aeronautics have been plotted. The figures used do not exactly correspond to those in the table in some cases, as a certain proportion of the aeronautical expenses of non-aeronautical departments, and particularly those for meteorological service along airways, have been counted in. In the case of the United States the figure plotted as the total governmental outlay on civil aviation includes the appropriations of the Department of Commerce, the Post Office Department's deficit on air mail, and the Weather Bureau's airway work.

It appears that the American government spends on the promotion of civil flying about a third more than France, Germany, and Great Britain together. The American government, however, gets more for its money than do those of most European countries. The airplane mileage flown in air transport under the American flag was more than three and a half times the combined

Foreign subsidies and appropriations

(Thousands of dollars)

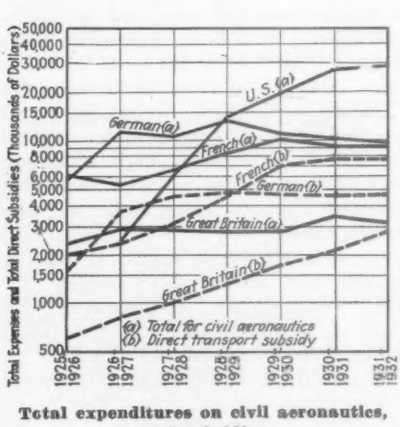
Country	Direct transport subsidy	Total for civil aeronautics	Total for military aeronautics	Total for all aeronautics
North America				
Canada.....	0	4,960[1]	3,200	8,160
Europe				
Austria.....	242	328	0	328
Belgium.....	650	2,300	.....	.....
Czechoslovakia	565	1,075	.....	.....
Denmark.....	66	97	736	833
Finland.....	11	50	750	800
France.....	7,840	9,210	90,790	100,000
Germany.....	4,480	9,790	0	9,790
Great Britain	2,290[2]	3,210[2]	100,000[2]	103,200[2]
Hungary.....	....	35	0	35
Italy.....	3,220	3,890	49,900	53,790
Jugoslavia....	141	156	4,220	4,376
Netherlands..	402	474	4,500	4,980
Norway.....	2	25	1,170	1,195
Poland.....	510	1,182	8,740	9,920
Roumania....	325	325	9,075	9,400
Russia.....	.....	12,000[3]	20,000[3]	32,000[3]
Spain.....	300	494	3,773	4,267
Sweden.....	160	219	2,510	2,729
Switzerland...	90	115	1,326	1,441
Africa				
S. Afr. Union..	224	228	750	978
Asia				
India.....	470[4]	1,725[4]	.....	.....
Japan.....	1,360	2,270	36,400	38,670
Oceania				
Australia.....	474	962	2,615	3,577
New Zealand..	....	56	.....	.....

[1]Also $1,912,000 paid out on air mail contracts. Air mail income unknown.

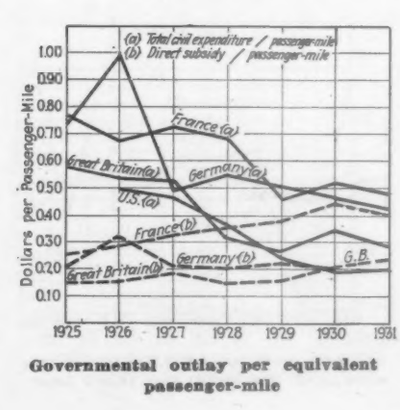
British civil aeronautical expenditures given are net, with amounts repaid by Dominion and Colonial governments excluded. Military appropriations and total are gross, including expenditures borne by the Indian government, since the Indian Air Force is essentially a part of the Royal Air Force.

[3]Russian figures are based on an assumed purchasing power value of 11 cents per ruble. If the ruble be taken at its normal value of 50 cents, which is required in official exchange transactions, the total expenditure would be $145,000,000.

[4]As noted under [3], Indian military figures have been transferred to Great Britain. The Indian expenditure on civil aviation goes largely into the preparation and maintenance of ground facilities for Imperial Airways' Empire service



Total expenditures on civil aeronautics, and subsidies



Governmental outlay per equivalent passenger-mile

totals for the three countries just mentioned. The American passenger mileage is three times the aggregate passenger mileages of the other three. Those are facts worth bearing in mind for the benefit of the individual, occasionally still encountered, who wants to know why aeronautical developments in America lag so far behind those in Europe.

In the lower curve both direct subsidy and total civil aviation expenditure are given in terms of dollars per equivalent passenger-mile of traffic, taking a ton-mile of express or mail as equal to ten passenger-miles. It is the traffic actually handled, not that for which capacity is provided, that is used in its calculation—so that if it appears that the government is spending 30 cents per passenger-mile on civil aviation where the passenger fare is only 6 cents, the contribution of the government is five times that of the patrons. In the past it has been conventional to reduce these subsidies to dollars per mile flown for purposes of comparison, but transport airplanes vary widely in size, and that course was unfair to the large machine.

The French and German contributions to civil aviation have varied relatively little over the past three or four years, although the German figures show a gradual downward trend. Both remain in the neighborhood of 50 cents per equivalent passenger-mile total outlay, with direct subsidies of 40 cents in France and 20 cents in Germany. As previously noted, the civil aviation budget in Germany has to carry an exceptional amount of general aeronautical expenditure. If Germany had a military air force, it is probable that they could get the same results that they are getting now with their civil aviation and with the same general methods of operation with a total civil aeronautics expenditure of not more than 30 cents per passenger-mile.

The curves for Great Britain and the United States have shown a more definite tendency towards self-support, at least until the last year. The British seem to have struck a deadline at about 30 cents per passenger-mile, and to be unable to reduce their governmental expenditures below that point. Our own figure had fallen off steadily to 19 cents per equivalent passenger-mile for all governmental contributions, including the air mail deficit, in 1930. In 1931 it increased to 20 cents. The depression, and the consequent slowing down of the rate of increase of commercial traffic, is largely responsible for these checks to cost reduction.

In proportion to the actual amount of transport operation the government of the United States is spending just about one-third less than the most liberal of the three European nations leading in transport flying, and less than half as much as either of the others.

Although no curves have been drawn for Italy and the Netherlands, their

Annual airplane mileage in air transport

(Thousands omitted)

	1928	1929	1930	1931
North America				
Canada	182	491	1,000[7]	.....
Cuba	.....	.....	104	215
Mexico[1]	490	965	.....	1,100
Panama	.....	62	89	.....
Honduras	.....	51	94	.....
South America				
Bolivia	94	120	139	.....
Brazil	280	327	.....	.....
Chile	.....	192	350	.....
Colombia	581	765	728	.....
Peru	136	.....	294	400
Europe				
Austria	400	421	452	1,165
Belgium	229	354	715	795
Czechoslovakia	460	564	566	.....
Denmark	92	99	117	130
Finland	121	138	155	162
France[2]	4,534	5,850	5,839	5,700
Hungary	93	79	123	.....
Germany	7,110	6,470	6,719	6,200
Great Britain[4]	1,136	1,386	1,286	1,433
Italy	1,236	1,869	2,758	3,100
Jugoslavia	92	118	269	432
The Netherlands	1,008	1,234	1,208	1,610
Poland	667	859	809	915
Portugal	35	15	.....	.....
Roumania	.....	.....	46	45
Russia	3,104	4,426	6,070	.....
Spain	180	406	364	368
Sweden	200	126	133	214
Switzerland	330	364	470	.....
Rest of World				
Africa, British South	.....	55	154	.....
Australia	513	784	1,625	.....
Belgian Congo*	164	168	149	165
China	.....	.....	330	.....
India	.....	.....	72	.....
Japan	532	541	.....	.....
Netherland E. Indies	15	262	471	540
Persia	210	341	435	388
Siam	51	45	.....	.....
World (estimated)**	**22,800**	**27,500**	**29,000**	**38,000**
United States[6]	**10,472**	**20,243**	**34,400**	**43,395**

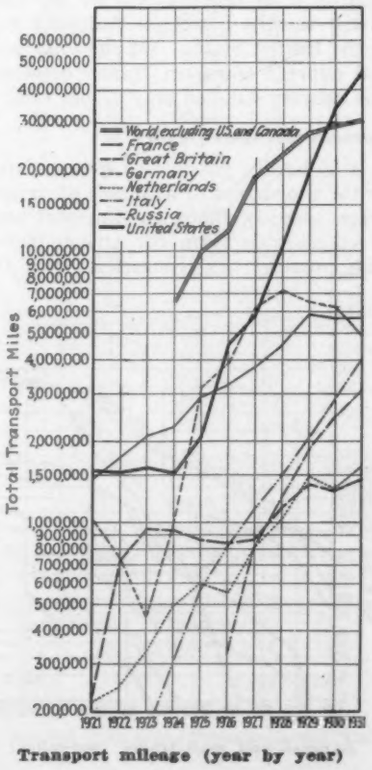
[1]Mexico — Excludes holders of U. S. mail contracts. Counted under U. S. [2]France — Includes numerous lines in Africa and South America. [4]Great Britain — Includes line across Asia to India. [6]Includes U. S. operated lines in Mexico, and Central and South America. [7]Approximated from partial returns. *Included above in Belgium. **Excluding United States and Canada.

Passenger traffic in passenger-miles

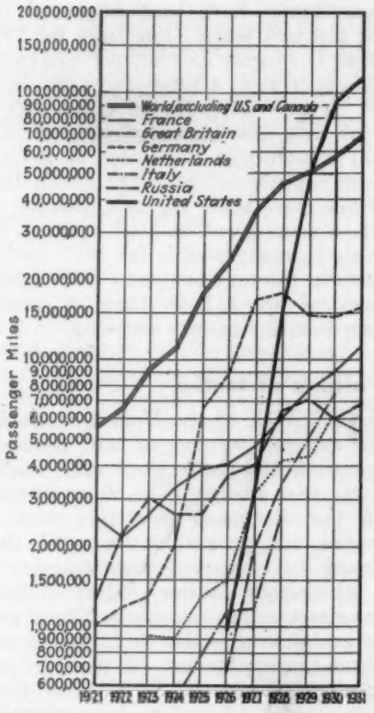
(Thousands omitted)[5]

	1928	1929	1930	1931
North and South America				
Canada	422	690	988	975
Colombia	1,300	1,552	.....	.....
Mexico	.....	510	.....	3,200
Europe				
Belgium†	.....	637	.....	.....
Czechoslovakia	750	1,422	.....	.....
Denmark	.....	313	.....	432
France	6,160	7,750	9,170*	11,200
Germany	17,820	14,775	14,300	15,300
Great Britain	6,476	7,127	6,011	6,988
Italy	3,485	5,295	8,100	*8,000
Netherlands	4,220	4,355	6,400	5,340
Poland	1,343	2,388	2,020	2,300
Russia	2,690	.....	.....	8,075
Spain	.....	725	.....	1,755
Sweden	.....	720	.....	502
Switzerland	.....	761	668*	†2,560
Rest of World				
Australia	545	1,532	4,050	.....
Japan	.....	470	.....	.....
World (estimated)**	45,800	50,300	57,200	67,000
United States	15,350	48,000	94,546	110,000

*Approximated from partial returns. †Including Congo. †† Including foreign operated lines. **Excluding United States and Canada.



Transport mileage (year by year)



Passenger mileage (year by year)

expenditures have been calculated for the last two years. For Italy the 1931 result is roughly 35 cents per equivalent passenger-mile, a little above the British figure. The Netherlands, with a small area and comparatively little airway construction to be done at government expense except in the Dutch East Indies, have made the best showing of all—6 cents spent on civil aviation for every passenger-mile in 1931 and 7 cents in the previous year. The operations of the K.L.M. have of course long been famous for economy.

Volume of traffic

OUTSIDE of the United States the general volume of air transport operation and traffic show only a relatively slow change. The object of most of the European countries was to spread out geographically until they should have covered their colonies in a satisfactory fashion. Most of them have now either approached their goal or are slowing down on further development work because of the need for economy. Only in Russia has there been a rate of growth approximating that of the United States in the last two years. Italy has also gone ahead comparatively briskly, while France, Germany, Great Britain, and the Netherlands, as judged in the figures, have virtually stood still. France and Germany show an actual decrease in mileage flown from 1929 to 1931, while the other two countries have registered an increase of less than 10 per cent in two years—two years in which the American mileage has increased by 130 per cent. The value of the services has been much increased by extension into new territory. Especially is that true of the Dutch and British lines to the East.

Express and mail traffic in ton-miles

(Thousands omitted)

	1928	1929	1930	1931
North and South America				
Canada	56	98	210	190
Colombia	93	144	.....	.....
Mexico	.....	38	.....	200
Europe				
Belgium	.....	66	.....	.....
Czechoslovakia	14	96	.....	.....
Denmark	.....	9	.....	14
France	639	824	910*	820
Germany	598	625	667	746
Great Britain	215	345	378	409
Italy	70	63	190	196
Netherlands	194	251	304	329
Poland	40	45	67	261
Russia	76	.....	.....	298
Spain	.....	6	.....	30
Sweden	.....	20	.....	53
Switzerland	.....	27	19*	†89
Rest of World				
Japan	.....	3	.....	.....
World (estimated)	** 2,330	2,870	3,320	3,800
United States	1,082	2,458	3,150	3,300

*Approximated from partial returns. †Includes Swiss and foreign lines. **Excluding United States and Canada.

Accidents

	Passenger fatalities per million passenger-miles								Average over last five years
	1924	1925	1926	1927	1928	1929	1930	1931	
France	0.90	1.03	2.69	1.25	0.97	1.29	0.25	0.84	0.87
Germany	....	....	0.44	0.54	0.22	0.48	0.68	....	0.48
Great Britain	2.67	0.00	0.00	0.00	0.00	1.68	0.33	0.00	0.46
Italy	....	....	....	....	0.00	0.57	0.24	0.00	....
Netherlands	2.10	2.31	0.65	0.00	0.00	0.00	0.00	0.38	0.14*
United States	....	....	....	0.59	0.85	0.28	0.24	0.22	0.29

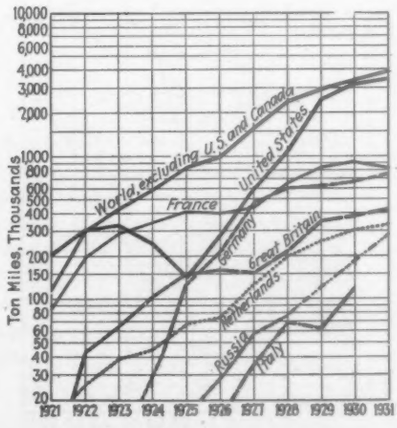
*Six years taken, to bring coverage up to 25,000,000 passenger-miles (All other averages based on at least 30,000,000; U. S. on 360,000,000).

The growth of the relative importance of express and mail traffic on the European lines is quite remarkable. America has the reputation of being the home of the air mail, while passenger transport by air was first intensively and intelligently developed in Europe. Nevertheless, at the present time mail and express make up only 23 per cent of the traffic on the American airlines, the passengers the remaining 77 per cent. In Great Britain the corresponding figure for mail and express is now 37 per cent, an increase of one-half in the last four years. In the Netherlands it stands substantially at the same level, while in France it is 42 per cent. Economically, mail and express are more important to American air transport than anywhere else in the world, but in volume of traffic they have less significance here than in the leading European countries.

The same conclusion develops from a comparison of the traffic statistics for the United States with those for the rest of the world. Roughly speaking, this country had 50 per cent more transport mileage flown in 1931 than all the rest of the world together, and 65 per cent more passenger traffic. Putting it in other terms, 60 per cent of the world's passenger transport was in the United States. Of the total mail and express transport traffic, however, this country handled only 47 per cent.

Commercial load factors

It is hardly possible to get statistics on the proportion of available passenger cargo space occupied on transport lines in comparable form for any considerable number of countries. In the United States no such figures are compiled, and in European countries they are figured on various bases—some including passengers carried free of charge, while others eliminate them from the count. Taking all that into account, such figures as are available show a rather remarkably small range for Great Britain, Germany, Italy, and some of the smaller countries. The British averages run somewhat higher than those for the continental countries, but practically all range between 35 and 50 per cent. Although the corresponding American figure can only be very roughly approximated, it seems probable that it lies in the neighborhood of 40 per cent for the American lines as a whole.



Express and mail traffic (ton-miles)

Passenger safety records

Contrary to another assumption which American tourists still seem occasionally to adopt, that it is safer to fly in Europe than in the United States, American accident figures show a notable and growing superiority over those for practically all European countries. On the basis of the average passenger accident figures for the last five years American transport flying has been 60 per cent safer than British, 65 per cent safer than German, and 200 per cent safer than French. British lines have gone through five of the last seven years without accidents, but a very bad year in 1929 brought their average record down.

The best record of all, however, although on a comparatively limited volume of operation, is that of the Netherlands. The fatality rate on Dutch airlines over the last six years has been less than half that on American lines over the last five, less than a third that of any other large European country. It is an extraordinary performance, especially in view of the inclusion fo the line from Holland to the Dutch East Indies.

Although the accident rate obviously is not unconnected with the efficiency of the operations, it cannot be taken as a direct and exclusive measure of their quality. In some cases where there is a large amount of flying over sea or over desert or over jungle the opportunities for fatal crash are exceptionally great. French airlines, for example, probably work on the average under conditions more difficult than those of most other European countries.

World plane ownership

WE NATURALLY look first at the table of airports, airplanes, and licensed pilots in the various countries of the world to see how the figures for other lands compare with those for the United States. There is nothing to disturb us in the comparison. The United States and Canada are not so far beyond all competition with the rest of the world in aeronautical development as in the manufacture and use of highway motor vehicles, but we are still well ahead. The United States has almost four times as many automobiles as all the rest of the world outside of Canada. For civil airplanes, the ratio is one and a half to one. For qualified civil pilots the ratio is even higher, more than 70 per cent of the world's licensed pilots being in the United States. Curiously enough, the proportion is still the same for civil airports, North America again having just a little over two-thirds of the world's supply.

Turning to the comparison of individual countries, it is surprising to find that the largest number of civil planes is licensed in France, for the French people have not had the reputation of being great users of aircraft of private ownership. An explanation is found in the lavish equipment of French transport lines, and especially those operating outside of France. The planes in use by the French transport companies outnumber, by nearly two to one, the total for all the other transport lines of Europe, and they outnumber by just a third the transport planes in the United States, where there is approximately six times as much operation as in France.

Germany is second in order, Great Britain third, and Italy fourth on total numbers of planes. On per capita ownership France still leads, with Great Britain second and Germany third among European countries, but none of them reach the standard of the United States, Canada, or Australia. Per capita ownership in the United States, in fact, is about three times as high as in any European nation.

The pilot figures by individual countries present little of novelty. Taking the world as a whole, it is common rule that the pilots exceed the civil planes in number by 50 to 100 per cent, the apparent surplus of pilots in the United States being only a little above the average for the rest of the world. No German statistics can be obtained, but aside from that the principal European countries rank in the same order as on plane licensing.

World distribution of airports, airplanes and licensed pilots

	Airports			Square miles of area per civil airport	Planes licensed		Population per airplane	Civil pilots licensed	Estimated production of civil aircraft
	Civil	Auxiliary	Military		Total	Transport service			
North America									
Canada	78	...	...	47,400	495	30	20,200	658	60
Central and South America									
Argentina	17	3	2	67,900	8	8	1,360,000	385	...
Bolivia	18	...	17	28,100	8	8	369,000	...	...
Brasil	17	29	5	193,000	38	15	1,060,000	31	...
Chile	8	3	6	35,200	32	22	136,000	...	...
Colombia	3	...	1	161,000	25	...	319,000	...	...
Cuba	36	22	2	1,240	...	...	.....	...	...
Mexico	194††	...	...	3,950	88	34	186,000	175	75
Peru	3	10	4	177,000	24	22	219,000	...	...
Uruguay	3	7	1	23,000	6	...	309,000	12	...
Europe									
Belgium	5	...	9	2,350	136	45	58,800	...	...
Czechoslovakia	6	...	13	9,040	111	...	131,000	...	60
France	39	60	34	5,450	1,500	639	27,200	746	373
Germany	94	140	...	1,920	1,067	151	58,500	...	200
Great Britain	54	99	45	1,750	984	31	45,000	2,404	470
Italy	30	...	70	3,980	684	...	60,200	708	350
Netherlands	4	11	10	3,300	64	34	119,000	87	25
Poland	21	6	...	7,100	113	30	268,000	125	24
Spain	14	43	19	13,600	119	...	191,000	102	10
Sweden	5	1	5	34,600	24	...	278,000	28	2
Switzerland	9	17	...	1,770	175	26	23,000	...	...
Africa									
South Africa Union	29	...	...	16,300	40	6	173,000	...	...
Asia									
China	...	...	...	.....	200	14	2,000,000	...	...
India	...	...	...	.....	40	...	60,000,000	...	...
Japan	7	21	17	21,200	92	...	685,000	...	...
Oceania									
Australia	87*	118	...	34,200	233	...	27,600	...	...
Dutch East Indies	6	55	...	122,000	9	...	5,500,000	18	...
World (estimated)[1]	**800**	...	...	.....	**6,750**	...	.....	**7,000**	**1,800**
United States**	**1,713**	**313**	**67**	**2,080**	**10,780†**	**561**	**11,100**	**17,739**	**1,582**

††Includes all classes. **Includes Alaska. †Licensed and identified. [1] Excluding United States and Canada. *Military included.

Aircraft production

FIGURES on civil aircraft production have always been very hard to get, but we have been able, by pooling the results of our own efforts with the figures obtained by the Department of Commerce through their commercial attaches in foreign countries, to get somewhat more complete and accurate data than ever before. Outside of the United States Great Britain appears as the leading producer, with most of the production accounted for in two or three factories. France, Germany, and Italy are fairly close together. There are no official figures on Russian production, but it probably lies somewhere between 200 and 400 civil machines a year, most of them of at least five-passenger capacity. The United States had about 47 per cent of the total production of the world in 1931—probably the first year since 1927 that our share has fallen below a half. For this table, the Chamber of Commerce report on machines built in established American factories has been used. Amateur construction is excluded.

World airport facilities

A CERTAIN degree of discrimination must be used in preparing airport figures, as a field which would be given the very highest rating in a poverty-stricken country or in some remote part of the world might be put into the auxiliary class in Germany or Great Britain. Neglecting any such differences, however, and taking the numbers of airports without question as officially reported, Cuba makes the best showing on the distribution of fields. Great Britain comes next, as might be expected in view of the large number of cities and of the enthusiasm for private flying that exists there. No other country equals the record of the United States on airport frequency.

It would perhaps be fair to compare Great Britain with the northeastern United States alone, rather than with the whole country. On that basis, our airport needs are better provided for than those of the British, for in New England and the Middle Atlantic states there is an average of about one field for every 500 sq.mi. as against one for every 1,750 sq.mi. of land area in Great Britain.

If recognized and listed auxiliary fields and military fields be taken into account, however, most European countries would outrank the United States on airport density. On that basis, Great Britain would average about one field for every 450 sq.mi. of land area.

EDITORIALS

AVIATION

EDWARD P. WARNER, *Editor*

An aviation platform

(Continued from February)

WE continue herewith the presentation of a program. A great deal has been said in the past three years about what various agencies, especially various departments of the government, ought to do for the aircraft industry. All that is very important, but it seems to us still more important that the industry find out what it can do for itself, and proceed accordingly. The platform, of which this is the third installment with still more to come, is a listing of a few of the most conspicuous and vital of the possible measures of regeneration from within.

Manufacturing *(Continued)*

4. Stop selling at a loss. Even after two years of depression and of forecasts that have gone sadly astray, there are a few fundamentals of economics and management to which we can cling. One of them is that the man who persists in selling his product for less than it costs to make, no matter how speciously attractive the arguments in favor of such a course may be, is ultimately headed for a receivership. Unless it is very clear that a turn for the better is in sight, it is better that no business be done at all than that it be done at a loss.

Three years ago, there was some justification for arbitrarily setting very low prices on airplanes in order that the public might be persuaded to acquaint itself with the product. The time for that has passed. Price is not such a factor in selling planes that there is any vast group of customers waiting to rush forward with extended check books if a few hundred dollars can be shaved off from what they have to pay. Experience has taught us that there are too many other factors that play a large part in conditioning the market. To continue price-cutting is to embark the industry on a policy of mutual extermination without any compensating returns. It may be necessary, under existing conditions, to overlook such items of overhead as rent and interest in figuring costs. It is fundamental, however, that no price ought ever to be set at less than 10 per cent over the cost of manufacture, including executive salaries, the upkeep of the plant, and the maintenance of sales and other departments outside the factory proper. Unless that can be realized it is better to build planes only on order for people who know what they want and are willing to pay what it costs.

While all these precepts have been put in terms of commercial practice, they apply with equal force to the sale of military planes. Bidding regardless of cost in order to get a contract on a competitive basis, combined with the not unnatural willingness of the services to take advantage of the lowest prices that can possibly be obtained, has been the curse of the aircraft industry at more than one period of its history. As a general rule it is better to let business go and to shut down a factory than to keep it running by getting orders on such terms.

5. Stop price concessions on used planes. A particular form of price-cutting, and one of the most aggravating forms, is the offering of extravagant allowances on used equipment, or the making of sundry freak concessions on the terms and extent of payment for a newly-purchased plane. If there is one thing which can do the aircraft industry more harm than general competitive price-cutting among manufacturers, it is the hidden and variable form of price-cutting which results from variable and excessive allowances on used planes, —and for that matter, on anything else, from outboard motors to grand pianos, that the would-be purchaser may possess. The automobile industry has been through that repeatedly, and has struggled with it constantly, with some measure of success. The manufacturers of airplanes will have to take the matter in hand promptly and police their own field, if they expect their advertised prices on the product to command any respect. The selling of airplanes is a necessary part of a great industry. If the industry is to survive on a sound footing, it must not allow its selling to drop into a process of haggling like that which attends upon the purchase of a rug from an Arab merchant in an Algerian bazaar.

Among remaining items of the platform to be covered next month are:

Give sportsmen an incentive to use airplanes.

Get more seaplane bases established.

Cooperate in foreign markets.

Seek control of amateur construction.

Present a united front to military procurement officials.

Agree upon an industry policy on the regulation of civil design.

NEWS OF THE MONTH

The Far East

WHILE delegates to the Disarmament Conference at Geneva discuss the possibility of limiting the strength of air forces, the air arm is held under the spotlight of world attention in the Far East. Mainstay of the Japanese forces in the Shanghai engagements has been the group of 60 planes from the aircraft carrier Kaga, one of the three with which the Japanese navy is equipped. China is said to have a small efficient air force, including Vought Corsairs, Douglas bombers, and Armstrong Whitworth fighters, most of them stationed at Nanking and Canton. China also has a large group of craft highly ineffective, either because of age or because of unfitness for military service. It includes 130 Vickers Vimy transports, purchased twelve years ago, and in part still contained in the original crates. Photographs of Chinese planes in the war area also show Avro 504 K's and Breguet 16's, both of 1918 vintage. Though eighteen Chinese planes were seen defending their airdrome west of Shanghai and another was shot down in a duel in which its opponent also fell, Japanese aerial maneuvers have been for the most part unresisted except by anti-aircraft guns which accounted for one invading plane. Admiral Shiozawa early in the hostilities expressed his "shyness" of wrecking Shanghai and ordered his pilots to use only small bombs. It is not clear what "small" means in figures, but one bomb shattered the roof of a railway station and killed 150 Chinese within its walls. One high explosive and one sulphur bomb "accidentally" released were sufficient to completely wreck a Chinese cotton mill within the International settlement. Chinese artillery has been effectively silenced in recent drives. It is not yet clear how great a "moral effect" the bombing has had.

Disarming at Geneva

In the first days of the Disarmament Conference at Geneva much was said of bombing planes. The speeches of the heads of the several delegations, in fact, appeared to leave bombing aircraft without a friend. There was general talk of the desirability of their abolition. The Italians and Russians favored it with enthusiasm, the Americans showed much more reserve on the point. Most specific and far-reaching were the proposals of the French. They suggested the internationalization of civil aviation (as outlined in "Air Armament Standards in the Melting Pot" in February AVIATION), to include the direction of all air transport lines, by an international association, and the prohibition of the private ownership of planes of large size. They also called for an international police force to have the monopoly of possession of heavy bombardment planes. Two tons was suggested as the maximum empty weight for free incorporation in national air forces. But French delegates, possessors of the strongest air force in the world, had nothing to say of limiting or reducing their own air power.

Upon the air forces fell the main burden of the opening stages of the struggle for the control of the Hawaiian Islands, which is engaging the Blue and Black forces in annual Army-Navy war games. In raids by 150 planes on four of the islands, Blue "lost" 45 planes, but inflicted heavy damages on the Black stores and headquarters before returning to the aircraft carriers. One of these, the Saratoga, was "put out of commission" shortly afterward by bombing airplanes of the defense, but as yet no really decisive action has been accomplished by either side. Blue seized a short base at Hilo, 150 miles east of Honolulu, and can operate its planes from the field as well as from the fleet.

"United air force" again

While executives of the services keep one eye on Hawaii and Shanghai and the other on Congress, source of much concern is the bill to establish a department of national defense, introduced in the avowed cause of increased economy in organization, by Representative Byrns of Tennessee. It would include a united air force. The old arguments pro and con have been recited again. The Secretaries of War and Navy both have signified to the House committee in charge their undying opposition to the measure, on grounds that it would result in decreased efficiency of the services because of the dissimilar conditions under which they must function. Admiral Moffett, Chief of Naval Aviation, agrees. General Foulois, Chief of the Army Air Corps, however, though he considered the proposed bill impractical as drawn, indicated his sympathy for the general scheme of a united air force and his desire to see a general survey made of the general organization of the national defense.

The announced intentions of both majority and minority leaders in House to support cuts of appropriations to the lowest possible figures are being reconsidered in the light of the war news from the Far East. The Army appropriation bill thus stands a better chance of escaping drastic reduction. The Senate, at the instigation of Senator Bingham, amended the first deficiency bill to provide $100,000 for additional flying time for reserves. The House, after much debate, refused to accept the amendment, and the Senate gave way. The reserves get no additional money. The Vinson navy bill, providing for increased aircraft-carrier and flying-deck-cruiser tonnage, has been put aside.

Airship scandal?

Interest in recent airship matters has centered around Congressional hearings on charges by two former Goodyear-Zeppelin Corporation employees that much defective material and workmanship had been passed in the construction of the Akron. The charges were vigorously denied, of course, by Naval and Goodyear-Zeppelin officials. The sub-committee of the House Naval Committee appeared to be favorably impressed with the replies to the charges and made an inspection trip to Lakehurst in company with Lieut-Col. E. C. McDonald, one of the airship's critics. No conclusions have been announced.

It came out in the hearings that the Navy is willing to sell the Los Angeles for commercial use, though probably not until the Akron's sister ship, due to be

Calendar

March 24-27	Air Carnival, New Orleans.
April 2-10	National Aircraft Show, Detroit, Mich.
May 22-30	International Conference of pilots who have made trans-Atlantic flights, auspices Italian Aero Club, Rome.
June 17-19	International Air Pageant, formal opening of Aviation Country Club of Lake Champlain, Westport, N. Y.
June 25	13th Annual Royal Air Force Display, Hendon, England.
July 28	Pre-Olympic Air Show, San Diego.
Aug. 1-6	International Soaring Contest, Wasserkuppe, Germany.
Aug. 11-28	International Air Tour, auspices Aero Club of Germany
Sept. 25—Oct. 8	Gordon Bennett Balloon Race, Basle, Switzerland.
November	XIII Aeronautical Exhibition, Grand Palais, Paris

completed in January, 1933, has been commissioned. A number of inquiries have been received, including one from Howard Hughes, aero-cinematic impresario. The Goodyear-Zeppelin Corporation is considering making an offer. It has been suggested that proceeds from the sale be devoted to the additional expense of enlarging the new airship to a capacity of 7,500,000 cu.ft.—a proposal which Admiral Moffett favors. ZRS-5 would thus be larger than the new German LZ129, which is to have a capacity of 7,250,000 cu.ft.

While its merits were being debated, the Akron weathered successfully a severe tilt with the elements in the course of a practice tactical exercise with surface ships of the scouting force. While passing down the east coast to engage in the fleet exercises off Florida, the airship encountered low fog, sleet, snow, and rain, which gave it a strenuous test. During the first night ice collected on some parts of the fin to the depth of 6 in., and a coat of ice formed on top of the hull. No difficulty nor apparent hazard resulted. Feature of the trip was the successful mooring to the airship-tender Patoka off the Virginia Capes. The next step in preparation for the maneuvers in the Pacific was the installation of four special Curtiss fighters in the airship's hull hangar. These machines will need no landing gears when operating with the airship, and performance should be correspondingly high in spite of limitations of size and weight.

Now accepted as a tried and tested craft, the Akron is about to have a new commanding officer. To round out his naval experience, Lieut.-Comdr. Charles E. Rosendahl, survivor of the Shenandoah disaster and for six years the Navy's ranking airship skipper, is to be sent to sea on a surface vessel. Comdr. A. H. Dresel, now in command of the Los Angeles, will succeed him.

The introduction of airships into civil air transport on trans-oceanic passenger and mail lines would become possible under bills introduced into the House and Senate by Representative Robert Crosser and Senator McNary. Like the Parker-McNary measure introduced last winter, both provide for mail contracts on fairly liberal terms and for construction loans at low interest rates, like those by which the federal government supports the construction of new merchant vessels.

Air space ownership restricted

The material immediately following, together with reference to legal and legislative matters elsewhere in the news pages, is based largely upon the Aviation Law Service prepared by the Commerce Clearing House, Inc. AVIATION is licensed to make use of the service, and is able to give its readers the benefits of the work of an organization specially trained and equipped to insure the complete collection of pertinent material on current legal developments.

The right of a landowner to the air space above his property has again been argued in a re-hearing of the famous case of Swetland v. Curtiss Airports Corporation. Owners of property adjacent to the airport which the Curtiss company had been developing near Richmond Heights, Ohio, had asked for an injunction against the airport because of the continuous low flying over their homes and the dust from the flying field. The lower court granted it. The United States Circuit Court of Appeals confirms the injunction, but narrows the grounds on which it had originally been issued. The court denies that low flying in a single instance constituted a trespass, but allows that repeated passage might create an objectionale nuisance. Whether or not it did would depend on the particular circumstances. Denying the absolute ownership of air space, the decision is very encouraging to aeronautical interests.

The final draft of a uniform aviation code for adoption by the states, under consideration for some time by the Aeronautical Law Committee of the American Bar Association (previously discussed in AVIATION, October, 1931, p. 569), was drawn up at a meeting of the committee in St. Louis recently. The code, which defines the ownership of air space above privately-owned property as well as liability of aircraft for damages to passengers, baggage, and freight, will be submitted to the association at its annual meeting in Washington this fall. Upon acceptance will follow action to persuade states to amend their statutes in conformity with the proposed code.

International Bulletin 7-A

Legal standardization on an international scale will be among the deliberations of the Seventh Pan American Conference in Montevideo, Uruguay, in December of this year. The Convention on Commercial Aviation, signed at the Sixth International Conference of American States in 1928 and so far ratified by five countries, including the United States, will form the basis for the study.

Some ten years of debate by the International Commission for Air Navigation have finally resulted in the formulation of regulations governing structural design and the issuance of certificates of air-worthiness. Somewhat vague in many details, they are to be put into effect in the 28 countries parties to the convention of 1919. The regulations generally resemble French practice.

Coincident with announcement of the suspension of work on the biggest British flying boat are details of the projected Dutch giant destined for use on the Amsterdam-Batavia route. Almost twice the size of the Do.X. it will be a monoplane of light metal and rust-proof steel, with the engines and most of the passenger quarters installed in the wing. Ten 1,000 hp. engines of low fuel consumption will give it a speed of about 140 m.p.h. and with a normal passenger load of 200 persons and two tons of freight range of 2,200 miles. It is, as yet, a paper airplane. F. Koolhoven, well-known designer since 1912, guides the project.

The engines of the airship R.101 were the inspiration of several years' research on "steam-cooling." Final experiments of several months' duration with day

COMMEMORATING A FAMOUS FLIGHT

This monument to the trans-Atlantic flight of a squadron of Italian seaplanes was dedicated early in January at Boloma, Natal, on the first anniversary of the take-off from that point.

TWO NEW GIROS

In England have appeared the new cabin and open cockpit models, each fitted with the three-bladed rotor system which folds back as shown.

and night bombing planes and a multi-engined transport are expected to prove the efficiency of an evaporative cooling system which not only effects a saving of weight as great as 100 lb. in a 500 hp. engine, but also reduces dangers of engine temperature variations. Water circulating between the cylinder jackets and a pressure tank generates steam. The steam rises to the condenser, is reconverted to a liquid state, and begins the cycle anew.

Faster fighters, faster bombers

A possible addition to British line-up of high speed fighters is the Vickers Jockey, a single seater fighter undergoing trials at Brooklands aerodrome. A top speed of 238 m.p.h. is attributed to it at the high altitudes where its supercharged 530 hp. Bristol Mercury engine reaches its full power.

Greater speed, efficiency and comfort will be insured Army Air Corps pilots by recent acquisitions of the Materiel Division. The new P-6E single-seater pursuit biplane powered with a Curtiss V-1570-C 600 hp. engine has a speed of almost 200 m.p.h. at sea level and climbs at 2,400 ft. per min. toward the higher altitudes where the newly-tested electrically-heated gloves facilitate the pilot's work. A newly perfected 40-lb. radio, capable of transmitting and receiving either voice or code on about one-twentieth the power used by a curling iron, can keep the pilot in constant touch with the ground and with other planes at a distance of 70 miles. Developed under the direction of Capt. H. M. McClellan, army radio expert, and tested by the Ninety-fifth Pursuit Squadron at March Field, Cal., the tiny set fits in a space of less than a cubic foot behind the cockpit and has a 12-ft. aerial strung from wingtip to tail.

After six months under special guard at the Martin plant in Baltimore, a new bombing plane carrying a crew of three men has been delivered to the Army Air Corps for testing. Twin Hornet engines, developing about 1,200 hp., built into the wings of the plane and a retractable landing gear put it among the fastest bombers in the world, with a speed of more than 180 m.p.h. The Boeing monoplane bomber delivered to the Army last summer, also twin-engined, has a speed of the same order.

Air races emancipate women

National Air Race innovations already announced for the coming fall include an extended use of handicaps in closed-course events and the introduction of a 3-mile oval course with one straight-away directly in front of the grandstand and the whole course in full view of the spectators. The high-speed events, such as the Thompson Trophy and Aerol Trophy races, will be flown over a 10-mile triangular course as formerly. There will be more stress on free-for-all events than in the past, less attention paid to races for A.T.C.-holding machines.

Another important novelty will be the abolition of sex discrimination. Heretofore the women pilots have been restricted to races for women only. This year, they may enter everything. As in 1931, a series of zone meetings are being held under Cliff Henderson's direction to discuss tentative rules and program.

Changes are to be made in this year's King's Cup race in England. It will be run on two days, the first day's event a trial heat to qualify a maximum of 50 machines. With the removal of the amateur ruling in force last year, any civil airplane capable of a speed of 110 m.p.h. or more and any pilot with at least 100 solo hours will be eligible. The course for the first day will be 750 miles long, that for the final race 500 miles.

Clarence Chamberlin recently added a high altitude flight to his exploits with his Packard-diesel-powered Lockheed, and made effective answer to critics of the diesel who have alleged that the type would not run at all at high altitudes, since the heat of compression at low atmospheric pressure would be insufficient to fire the charge in the cylinder. Chamberlin reached an altitude slightly in excess of 19,000 ft., probably a record for a compression-ignition-engined plane. So far from the engine having refused to run, press reports of the flight stated that the throttle had to be closed slightly at the high altitudes to hold a constant r.p.m.

While on the West Coast during a recent trans-continental survey trip for the Texas Company, Frank Hawks squeezed a round trip flight between Agua Caliente and Vancouver into the fast time of 13 hours and 44 minutes (2,250 miles; 164 m.p.h.). He used his well-known Travel Air S. Though his time is a record for the round trip, Hawks failed by 6 minutes to break the one-way record to Vancouver held by James E. Wedell.

Pilots out, A.L.P.A. in

The first strike, or lockout, or combination of both, on a United States airline has occurred. Pilots and executives of Century Airlines failed to agree over a wage readjustment and the former, members of the Air Line Pilots' Association, on Feb. 9 ceased being employees of the company. All flights were cancelled until a new pilot force might be collected. Unusual significance was attached to the episode because of its lack of precedent in American airline circles. The company had sought to change pilot salaries from a fixed to an hourly rate. The company officials said the change would amount to a 15 per cent wage reduction over a period of a

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year. The pilots said it would be 50 per cent. The Air Line Pilots' Association has rallied round its unfortunate members, with all the preparations traditionally associated with labor unions at war. All members who have positions are to be assessed, that strike benefits may be paid. Any pilot taking employment from Century while the old pilots remain inactive is to be blacklisted by the Association. Century's operations are to be picketed, both on the ground and in the air. The struggle will, unless a compromise is very promptly reached, go far to determine the future of the Pilots' Association, whether it is to be a negligibly weak body with interests largely social or an extremely powerful and aggressive factor in determining the operating and personnel policies of the air transport lines.

Ludington Lines causes another stir in the air transport field by announcing intention to step up its hourly service between New York and Washington to a half-hourly frequency in April. Twenty round trips daily is the plan. Eleven are flown at the present time. The trips on the half hour will be nonstop flights between the two terminals, the flying time 80 minutes, Consolidated Fleetsters the equipment. Thus Ludington is added to the list of operators no longer considering multiple engines essential for passenger service.

Effective Jan. 16, the company set new low rates for the New York-Washington service. Formerly $13.25, the through fare now is $10; the round trip $18.50 instead of $20. The base fare is down to 5 cents a mile. Object, to attract patronage during the winter months. Eastern Air Transport, Ludington's competitor, has announced no corresponding change, but maintains the $13.25 one-way rate.

Massachusetts, last summer the scene of the first railroad operated airline, is now considering a bill authorizing railroads generally to operate both motor vehicles and airplanes.

Early objection of several railroads to the issuance by the Illinois Commerce Commission of certificates of convenience and necessity to three air transport companies whose schedules to some extent coincided with the railroads, was later removed. The commission decided that since the type of transportation offered by the airlines was not rendered by the railroads there was no objectionable conflict.

All-Red Cape-Cairo complete

Chief among new services inaugurated is the Cairo-Cape Town run of Imperial Airways. The first through flight started from Croydon Jan. 20. The new part of the Empire system consists of the operation between Nairobi and Cape Town, the Cairo-Nairobi section having been opened on Feb. 28, 1931. The flight from London to Cape Town, almost 8,500 miles, consumes twelve days. All planes used are large (at least 3,000-lb. payload capacity) and multi-engined. Armstrong Siddeley Argosies are used between Cairo and Khartum, Short Calcutta flying boats between that point and Nairobi, de Havilland Hercules between Nairobi and the Cape.

WASPS IN EUROPE

The new Fokker tri-engined transports in use on K.L.M's weekly Amsterdam-Batavia passenger and mail service are fitted with Pratt & Whitney engines.

Imperial Airways has taken delivery of the eighth and last of its fleet of Handley Page four-engined biplane transports of the Hannibal type. Four are in service between London and Paris and the balance are operated between Cairo and the Near East, relieving the Hercules machines for the African service. The continental Hannibals are fitted to accommodate 38 passengers, the others but eighteen, to provide greater comfort in the warmer climate.

New Pan American service

New services include the 36-hour air-rail service between New York and points served by Pan American Airways at new low combination rates ($115 New York-Havana), and the 259-mile extension by United from Omaha to Watertown, S. D.

T. A. C. has moved its operations headquarters from Pontiac, and its sales-purchasing department from Cleveland, to the hangar at the Detroit City Airport. The company will resume the amphibious trans-Lake Erie service between Detroit and Cleveland April 1. It has followed up its experimental inter-continental airway work of last summer by negotiations with foreign governments for leases on suitable landing points along the route.

Eastern Air Transport has shifted its Miami terminal from the Pan American airport on 36th St., Miami, to the Miami Municipal Airport. Robertson Airline's service between St. Louis and New Orleans has been discontinued. Century interests hint at fifteen-minute schedules between mid-Western cities within six months.

United Airlines and Western Air Express have speeded up their combined Los Angeles-New York passenger service by two hours, making possible an all-air, day and night trip between the two cities in 28 hours and 40 minutes. The night section of the flight is between Salt Lake City and Iowa City.

Eastern Condors hushed

Further contribution to passenger comfort is to be made on planes of the Eastern Air Transport lines by the installation of a muffler for engines reported to reduce noise by 70 per cent (units of measurement not stated). A single exhaust manifold two and a half times the diameter of the old type contains vanes to give the exhaust gases a whirling motion, so using up their energy before release into the air. Designed and developed under the direction of Chief Engineer Ralph G. Lockwood [author of recent maintenance articles in AVIATION], it has been in use for three months in several of the company's Condors, and will soon be standard equipment.

Varney Speed Lanes is reported attracting heavy traffic on the Los Angeles-San Francisco run and forcing a general stepping up of schedules to match its 1 hour, 58 minutes service with Lockheed Orions. The Pacific Air Transport schedule was recently advanced from 3 hours to 2 hours, 45 minutes, then to 2 hours, 30 minutes.

All-expense air tours are being promoted by Air Tours, Inc., arguing the advantages of air transport on week-end trips and limited vacations.

Possibly-far-reaching negotiations

were held in January between French and German representatives regarding consolidation of interests in developing Europe-South America services.

All employees of United Air Transport are included in a group life insurance plan recently taken out by the company. Each pilot is insured for $5,000, each mate for $3,000.

Express continues to receive extra attention. T.W.A. has arranged for the air-bus service started in October in cooperation with the Greyhound lines to include packages as well as passengers. Packages now are received at all Greyhound stations and forwarded through coordinated schedules by air and bus. Century in January began filling an express contract with the Chicago Mail Order Company for transportation of packages daily to Cincinnati for mailing. The service will be expanded to include other key mail distributing points. A promotion and advertising campaign is to be started soon by the Railway Express Agency and the lines with which it has contracts to increase patronage of the system under the new rates announced two months ago.

Paul Goldsborough announces that the work of "radioizing" the airways for the transport companies, undertaken about two years ago by Aeronautical Radio, Inc., is about 90 per cent complete. Equipment has been installed in about 90 cities, and is predominantly of the radiophone type.

Century-Pacific had its first major accident on Jan. 29 when a tri-engined Stinson crashed on a mountainside in the Tehachapis, about 30 miles south of Bakersfield, not long after it had taken off from that point. Weather conditions were extremely poor, and it appeared the machine had struck the ground while the pilot was attempting to go back to Bakersfield. Century-Pacific service, already extended from Tucson to El Paso, is reported likely to go through to St. Louis soon. The Arizona Railroad Commission has postponed hearing the line's application for new certificates of convenience and necessity until March.

Lawmakers think about parachutes

The Century crash revived agitation for compulsory installation of parachutes in passenger transports, though there is little in the circumstances of that tragedy to suggest that parachutes could or would have been used. Some excitement has been aroused by the appearance of an article in *Forum* by a parachute enthusiast, painting the alleged perils of air transport in lurid terms. A parachute-exacting bill was introduced in the New York State legislature in January. Early in February a bill was introduced in Congress by Congressman Celler of New York to require parachutes for all passengers in all interstate transport flying.

The first bill to be introduced in the present session of Congress regarding air mail would fix $1 per mile instead of $1.25 as the maximum compensation for space, and would limit the route certificate to three instead of ten years. It was introduced by Representative Brunner of New York and was referred to the Post Office Committee. It would have no practical significance, as no contractor gets over $1 a mile now.

As a result of a resolution introduced into the Senate early in December and recently agreed to, the Committee on Post Offices and Post Roads will investigate air mail contracts and methods of transmitting mail from airports to post offices. A further resolution requested the Postmaster General to provide the necessary detailed information about individual contracts. The Senate is also investigating, at the behest of Mackellar of Tennessee.

East St. Louis and the Curtiss-Steinberg airport have been campaigning for the designation of that field as the St. Louis air mail terminal instead of Lambert-St. Louis Municipal Airport. Hearings have been scheduled with Postmaster General Brown; indications were that a change at the present time is unlikely.

T.W.A. reports that mail traffic over its line has increased six-fold since the Post Office Department ordered rerouting of mail between Los Angeles and New York in January. About $25,000 is being spent equipping many of its fleet of Fords with wing mail bins.

The first Philippine air mail was opened Jan. 25 between Manila and Baguio by Philippine Air Taxi.

Airway over the Berkshires

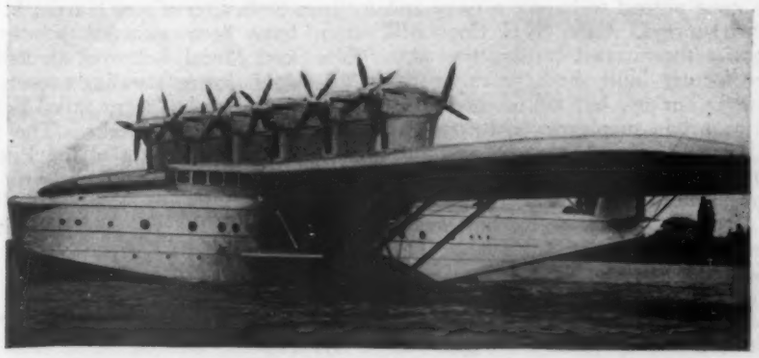
A survey is to be undertaken soon of the recently authorized 121-mile federal airway between Boston and Albany by way of Springfield, Mass. American Airways received the mail contract for the route among the extensions granted last summer, but will not begin operating it until the beacons and intermediate fields have been installed. The revised edition of Aeronautics Bulletin No. 11, which covers regulations regarding intermediate fields, reveals that the restrictions limiting them to emergency landings have been lifted to include all properly supervised operations considered for the public good.

Following growing sentiment in favor of state development of intra-state airways, Michigan has taken over the beacons privately installed and operated by Transamerican Airlines, and the Illinois State Aeronautics Commission has prepared elaborate plans for a state airways system when money becomes available.

Along with the interest in developing state airways is developing the idea of state licensing of airports. Recently the Illinois State Aeronautics Commission announced that after Feb. 15 airports within the state could not be operated without a license from that body. The first annual report of the New Jersey State Aviation Commission includes the recommendation that New Jersey ports be licensed. That state includes two of the busiest civil fields in the East, Central Airport at Camden and Newark Municipal Airport. The latter experienced a tremendous growth in traffic last year, passengers cleared amounting in 1931 to 90,858, as against 22,356 the year before.

Representative LaGuardia of New York, aviation enthusiast, has asked the House to provide a public terminal airport at Governor's Island, New York harbor Army post, and has introduced a bill authorizing appropriations to increase the present flying field area of the island for that purpose.

The expensive bulkheading and fill at the site of the new Baltimore Municipal Airport may not be as unsatisfactory as was feared last summer, when an engineer's report indicated the work to date had been basically wrong. A newly-consulted expert believes that the mud fill will dry out with the passage



ITALY'S DO.X

The Italian model of the Do.X, the second of the type built by Dornier. Streamline cowls enclose the engine mounts and the engine cowls have been considerably smoothed up in comparison with the first model, now in this country.

of time. Kansas City has appropriated $58,140 in airport bond funds for a levee to protect its municipal port. Birmingham Municipal Airport has received the A.T.A. rating. Miami has bought a 1,730-acre tract which will connect up the municipal airport, the Naval Reserve field and a tract designated for lighter-than-air use by the Navy.

Roosevelt Field reports a net profit of $1,265 after expenses and depreciation in 1931, as compared with a net loss of $127,781 in 1930. Hangar rents at Oakland Municipal Airport have been lowered. The former monthly rate of $60 for six-place machines has been cut to $30, the $40 rate for four-place planes to $25.

There have been two bad hangar fires recently. Continental Airways lost its hangar and three planes, at the Chicago Municipal Airport, the damages amounting to $175,000. Three planes were destroyed by fire in the hangar on the private Dupont field in Wilmington.

Thompson Aeronautical Corporation reports a net profit of $10,945.20. Receipts from transport, sales and service operations totaled $952,663.87; nonoperating revenue netted $12,990.09, and expenses totaled $954,708.76.

Continental Motors Corporation, claiming a strong over-all condition, reports a net loss of $324,967.07 in the Continental Aircraft Engine Company subsidiary. Ugo V. D'Annunzio and J. V. D. Garretson of New York City have been appointed receivers for the American Aeronautical Corporation. The company has liabilities, exclusive of capital stock of $725,000, and assets of $2,130,000, most of them frozen in the form of the Port Washington plant.

Curtiss-Wright goes east of Suez

Curtiss-Wright has arranged with the Turkish government to undertake airport and airway surveys and the manufacturing of aircraft in Turkey. Maj. William B. Robertson and F. E. Hulse have gone abroad to handle airway and airport surveys. Capt. S. C. Coon will supervise the aircraft construction at a plane factory built three years ago at Kayseri, Turkey, but never used.

Stinson has supplemented its regular line (announced in AVIATION in January) with a new de luxe four-place cabin machine. Organization of Northrop Aircraft Corporation by the Douglas Aircraft Company is reported. It is understood that J. K. Northrop, formerly engaged in developing machines under his own name for United Aircraft, is active in the new Douglas subsidiary. Following the merger of Aircraft Products Corporation and Warner Aircraft, announced in the February issue, the former company is now designated at Prodcraft, Inc.

Despite economic difficulties and governmental economies, the aircraft industries of Europe continue active. Both France and Great Britain report aeronautical exports for 1931 well in excess of those of the United States. The Junkers company, of Dessau, has received a number of orders from unnamed foreign countries, and has increased the working staff from 800 to 1,000 and the working week from 40 to 48 hours.

A two-place Fairchild cabin monoplane, powered with a high-drive Cirrus, is now undergoing final trials. Tests are being run, also, on a Menasco Pirate installation on a Fairchild 22.

Giros go wandering, find new builder

Latin America's first contacts with the autogiro have come about through Lewis A. Yancey's recent flights to Cuba and Mexico. On Feb. 4, he made a landing at the site of the Mayan ruins of Chichén-Itzá, in Yucatan. On Feb. 7 he landed successfully in the high altitude of Mexico City, about 8,000 ft. above sea level, and later took off there.

Following an accident to one of the Navy's three giros at Quantico, Va., an official news release was issued stating the accident had been caused by the carrying away of one rotor blade. If true, it would have been the first time such a failure had occurred since giros had become commercially available. Following much excitement the Navy subsequently issued another release, declaring that the statements in the first were in error and that an investigation had been launched to determine whether the accident was due to material failure or to operation.

F. W. Steere Company, now of White Plains, N. Y., has been granted the fourth license to manufacture the giros by the Autogiro Company of America. Mr. Steere was the organizer of the Steere Engineering Company of Detroit. Vice-president and chief engineer will be Heraclio Alfaro, former associate of de la Cierva in Spain and with the Autogiro Company of America in 1931.

Juan de la Cierva and Harold F. Pitcairn have been awarded jointly the John Scott Medal, bestowed annually in Philadelphia for outstanding accomplishment. Senor de la Cierva sailed Feb. 10 after a visit of six weeks. The New England distributorship of the Pitcairn Autogiro has been placed with the New England Giro Company, lineal descendant of the old Boston Airport Corporation.

A medal for Dr. Eckener

At a special meeting of the F.A.I. in Paris, Jan. 14-15, the Grand Gold Medal of the Federation, awarded annually for outstanding achievement, was awarded Dr. Hugo Eckener for his services in his aeronautical career, particularly the trans-Atlantic flights of the Graf Zeppelin last year. The American delegates presented the name of Wiley Post for his round-the-world flight.

F.A.I. recommendations to be voted on by national aero clubs and the International Contest Committee include the suggestion for a system of route control of long-distance flights, so that pilots may receive credit for actual distance covered, instead of merely a straight line between take-off and landing points; also the creation of a round-the-world flight record and creation of records for amphibions and autogiros.

Air Features, Ltd., has been formed in San Francisco for the manufacture of signs for aerial advertising. The signs, with letters 10 ft. high and 6 ft. wide, are towed behind a giro.

Well-intentioned but rather hopeless is the recent introduction into Congress of the Schall bill, seeking the appropriation of $40,000,000 for subsidies to flying clubs.

Personnel

Harold Gatty has accepted appointment as chief air navigation research engineer in the Air Corps, with headquarters for the present in Washington.

R. B. C. Noorduyn, formerly vice-president of Bellanca Aircraft Corporation, is now executive engineer of Pitcairn Aircraft, Inc.

Lt. Col. Barton K. Yount, former Army Air Attaché in Paris, will become commandant of Bolling Field Aug. 1.

Dr. R. F. Longacre has succeeded Dr. Harold J. Cooper, medical director of the Aeronautics Branch, following Doctor Cooper's resignation.

Squadron Leader Orlebar, leader of the last three British Schneider teams, has been promoted to the rank of Wing Commander (equivalent to a Lieutenant-Colonel in the Army).

American commercial aviation lost one of its oldest and most colorful members Jan. 26, when Edward A. Stinson died of injuries received in a crash following collision with a flag pole during a forced landing at night in Jackson Park, Chicago. Eddie Stinson learned to fly in 1911, was an important factor in military aviation instruction during the war, was a veteran of all phases of barnstorming and exhibition days, and in later years became prominent as a manufacturer of the planes which bear his name. He was demonstrating the latest model at the time of the accident.

Charles Talbot Porter, one of the incorporators of the Huff-Daland Aircraft Company and for five years vice-president and chief engineer of the Keystone Aircraft Corporation, died Jan. 22 after a short illness. He was particularly identified with the development of the Keystone line of bombers for the Air Corps.

W. F. Halley, president of Rapid Airlines, died in Chicago Feb. 4.

SIDE SLIPS

By Robert R. Osborn

ABOUT a year ago, while studying the statistical issue of AVIATION, we came to the realization that some very important statistics were not included, even though the data as it was given, was undoubtedly of great value to the industry. There was plenty of information on such subjects as aircraft and engine production and sales, pilots, students, and mechanics licenses, and operations of airports and airlines. However, even though we could tell accurately just how many people were engaged in this business, we could not find any information as to what all of these people were doing all of the time. Knowing that the same question must have been unanswered for other subscribers and being ever anxious to be of service to our alleged reading public, we immediately set about to remedy this defect in our otherwise perfect magazine, and the data are presented herewith for the first time. At this point we wish to thank the committees headed by our able assistants, The Intrepid Aviator and The Sterling Mechanic, for their untiring efforts in collecting this data, and request them, for the third time, to return the box of cigars missing from our desk.

In the following tables will be found summaries of the duties and functions performed by several large classes of people engaged in aeronautical work, with the percentages of their active time taken up by the various functions:

AVERAGE PILOT

Functions performed	*Percentage of total time on "duty"*
A. Talking about anticipated parties	18.0
B. Explaining to Department of Commerce inspector	4.0
C. Talking about marvelous parties of the recent past	22.0
D. Relieving students of cigarettes	9.0
E. Actually going on parties	0.1
F. Explaining to students that it is too bumpy for spinning instruction just now	8.0
G. Kidding mechanics into making out flight reports	14.6
H. Explaining to beautiful young ladies and traffic policemen who have been invited out to take a flight that all of the ships are very busy that day, but possibly some other time—	16.6
I. Trying to kid mechanics into free gas, oil and service for personal automobile	23.8
J. Explaining to manager about great number of forced landings in one particular small town not on the regular route	18.0
K. Explaining to wife about great number of forced landings in one particular small town not on route	86.2
L. Reporting to mechanics that engine is rough, ship is wing heavy, tail vibrates, stick is loose, windshield is cracked and too yellow to see through, rudder pedals rattle, throttle rod is bent, tachometer doesn't work, oil pressure has dropped, radiator is leaking, brakes are grabbing, and seat is too low, and that the plane will be needed again in twenty minutes	91.9
M. Wishing for the good old days	13.0
N. Explaining to manager about head winds causing high flying time and large expenses on last special flight	4.6
O. Adjusting helmet, goggles and muffler and lighting cigarette nonchalantly, in position exposed to public view, before climbing into ship	1.3
P. Making mental notes on the airplane he is going to design some day which will be a world-beater	87.9

AVERAGE MECHANIC

Functions performed	*Percentage of total time at "work"*
A. Scaring students with wild stories	11.0
B. Lending money to pilots	0.0
C. Throwing practically new but dirty plugs out of back window and replacing with new ones	2.0
D. Avoiding lending money to pilots	90.8
E. Daubing grease on control sticks, throttles and upholstery	15.0
F. Attempting to recover loans to pilots	50.0
G. Explaining to manager that hangar is too cold for work	22.2
H. Arguing pilots out of requests for top overhaul jobs	6.0
I. Explaining to manager that hangar is too hot for work	22.2
J. Sleep	78.4
K. Warming up engines (included in J above)	9.7
L. Complaining about unreliable newcomers in business	32.0
M. Kidding Department of Commerce inspector into approving repair work	5.0
N. Sleep (should be added to J above)	21.6
O. Thinking of things he'd like to do to designers of engines and engine installations	100.0
P. Hunting for tail skid dollies	8.0
Q. Hunting for chocks	9.0
R. Opening and closing hangar doors	87.0
S. Closing hangar doors after others have opened them	50.0
T. Unaccounted for (probably should be included in J above)	19.0

AVERAGE DESIGNER

Functions performed	*Percentage of total time "at the office"*
A. Reading over financial page of local paper	37.9
B. Waving arms around in air and telling shop men to make up something "about like this" and then to let him see it	45.2
C. Complaining about performance data given out by the advertising department	8.8
D. Explaining to chief engineer that competitor's airplane will be heavier than his latest design after it has been strengthened sufficiently to stand up in service	5.4
E. Waving arms around in air and telling shop men that wasn't the way he said to make it up at all	66.3
F. Explaining to draftsman that that was the way he intended building it all along, but the suggestion is a good one	57.0
G. Telegraphing to engine manufacturer to ask if one cylinder and carburetor can't be moved as they interfere with gas tank and wing beam	85.6
H. Explaining to chief engineer that competitor's airplane really isn't that fast, and it is probably just a haywire airspeed meter reading	19.7
I. Writing to materials manufacturers asking why goods delivered can't be up to strength assumptions made in stress analysis	34.0
J. Looking over and measuring competitor's airplane at field	81.8
K. Arguing test pilot out of suggested changes	5.5
L. Explaining to chief engineer that failure of airplane to meet performance estimate is due to (1) overweights because of shop errors, (2) under power of engine, (3) interference of sales department	19.7
M. Changing all parts of experimental airplane to make it suitable for production	89.9

AVERAGE SALESMAN

Functions performed	*Percentage of total time "promoting"*
A. Commenting to secretary on excellence of secretary's smile	98.8
B. Dictating notes on changes required in present airplanes to make them salable	89.9
C. Checking over "Help Wanted" advertisements in local paper	78.7
D. Working up performance data of future designs by adding 10 per cent to advertised data on competitors' airplanes and engines	18.1
E. Checking up on itineraries of road shows of Scandals, Follies and Vanities, and locations of Elk's conventions in order to arrange next sales promotion tour	92.7
F. General complaining	100.0

FLYING EQUIPMENT

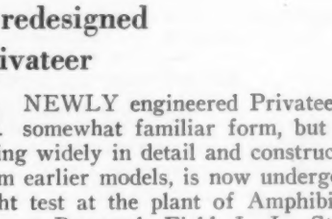
A new Stinson Junior

RECENTLY announcement was made (AVIATION, January, 1932), of the production of a new model of the Stinson Junior, by the Stinson Aircraft Corporation of Wayne, Mich. Although following the general lines laid down by the earlier models, the new machine incorporates certain changes which make for improvement in speed, stability and passenger comfort.

The principal variation is in the design of a new type of landing gear, in which fully streamlined wheels and shock absorber units are carried on the outboard end of small lower wing stubs projecting from the underpart of the fuselage. The wing-bracing struts extend outward from the ends of the wing stubs. The overall drag of the undercarriage has been reduced by these changes. The external lines have been changed somewhat, particularly in the shape of the wing tips, which have been rounded off considerably more than in previous models. A new V-type windshield also adds to the streamlining, and affords improved vision for the pilot.

Passenger accommodations have been improved by increasing the interior dimensions of the cabin 3 in. in width, and 4 in. in depth. Automobile practice has been followed in the decoration and arrangement of seats and fittings. A layer of balsam wool has been built into the wall to reduce noise, and adjustable safety glass windows provided. Heaters are installed for winter flying.

Standard equipment on the model R includes a 215-hp. Lycoming engine, rubber mounted; Eclipse electric starter; Hamilton Standard propeller; ring type engine cowling; Pioneer instruments; semi-air wheels with Timken roller bearings and self-energizing brakes; and full navigation and cabin lighting equipment, including a 12-volt aircraft storage battery.



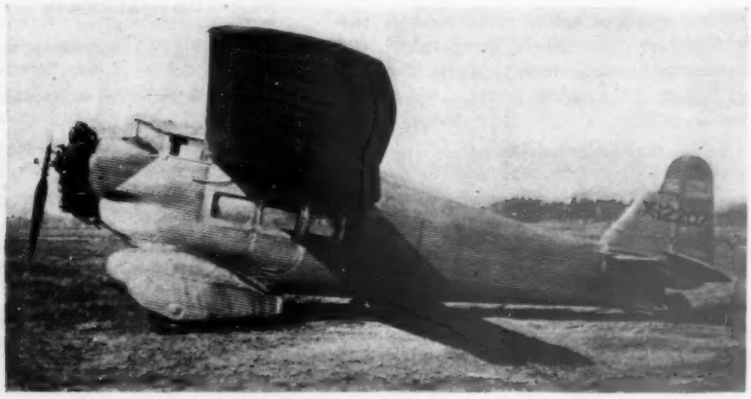
The model R Stinson

A redesigned Privateer

A NEWLY engineered Privateer of somewhat familiar form, but differing widely in detail and construction from earlier models, is now undergoing flight test at the plant of Amphibions, Inc., at Roosevelt Field, L. I. Structurally, the hull resembles land plane rather than conventional flying boat practice. The framing is of welded steel tubing and is designed to carry all stresses without assistance from bottom or side plating. The skin, therefore, is called upon merely to provide water tightness and to resist localized loads which might cause puncture or tearing. The bottom, which is of modified vee form, is of .065 in. Alclad bolted through to wood stringers and chines. The side covering, however, from chine to gunwales, is of fabric, graded from a heavy waterproof duck for the portion of the hull below the waterline, up through a medium grade duck, to standard Grade A aircraft cotton over the turtledeck. The covering is heavily doped and waterproofed, and tests have indicated that the canvas so treated is more resistant to tearing and puncturing than a metal skin of equal weight. A properly protected canvas is also highly resistant to deterioration from exposure to sea water. The use of a fabric skin also permits the use of double curvature in hull lines to improve aerodynamic properties, without requiring the use of complicated and expensive dies for the proper forming of metal and plywood.

The new Privateer

As before, the machine is a three-place pusher type monoplane with the engine mounted on a nacelle over the center of the hull. The most marked external change is in the abandonment of the open out-rigger supporting the tail surfaces in favor of a single fuselage-like boom. The tail boom, which is detachable from the main hull at a point just above the sternpost is a diamond-shaped girder, consisting of four longitudinal steel tubes, cross-braced at frequent intervals in both vertical and horizontal planes. The rear end of the boom flattens out to form the fin, and provides support for the rudder and



The Crawford all-metal plane

stabilizer. The entire boom structure is enclosed within a cylindrical fairing of plywood which does not carry any of the torsional or shear loads. The covering is faired smoothly into the afterpart of the hull, and into the fin. The wing, which is wire-braced both to the hull and to the engine mount, is of conventional design. The two spars are of wood, and ribs and ailerons are of stainless steel. The rudder and horizontal tail surfaces are also of stainless steel. All surfaces are fabric covered.

The retracting landing gear is similar in external appearance to that used in the old Privateer. An ingenious arrangement applying high-pressure air from the engine starting system has been developed to provide the power for retracting and extending the wheels. A steerable tail wheel which acts as a water rudder completes the undercarriage. The wing tip floats are of the usual Privateer construction, fabric covered over welded steel tube frames but have been redesigned to improve their streamlining. An interesting feature is the incorporation of an oleo leg in the rear strut to protect the rear wing spar in case the floats strike the ground.

The water tight enclosure of the cockpit has been so designed that vision in all directions, except directly to the rear, is practically unobstructed. Cockpit upholsterery is in removable panels, making it possible to get at control or to inspect the hull. Noise in the cabin is materially reduced by a lining of Dry-Zero in the walls and roof immediately below the engine and propeller.

Stabilizer adjustment is obtained through the use of adjustable rod struts, as in former models, although the shape of the strut has been changed somewhat to avoid interference with the action of the elevator.

In the present model the power plant consists of a model A-70 Continental engine of 165 hp. Oil tanks are located in the engine nacelle, and the main fuel supply is in the hull in a 48-gal. aluminum tank.

Aviation
The new Bird, powered with a 170-hp. Jacobs engine. Above: The Douglas B-7 bomber

Crawford all-metal monoplane

A SIX-PLACE all-metal monoplane has recently been test flown by the Crawford Metalplane Company, Los Angeles, Cal. The machine is of the high wing full cantilever type, the wing being of multi-cellular construction similar to the Junkers design. It is tapered in plan, and the angle of incidence changes progressively from root to tip. The fuselage is of monocoque construction built up of corrugated aluminum sheet, assembled by riveting.

The landing gear is unusual in that large sized air wheels are cantilevered out from the under part of the fuselage by means of a short wing stub. The wheels themselves are completely housed in torpedo-like enclosures. The machine is powered with a Wright Whirlwind engine of 220 hp. The general specifications are: Span, 42 ft.; length, 28 ft. 6 in.; height, 8 ft. 1 in.; wing area, 220 sq.ft.; gross weight, 3,500 lb.; wing loading, 15.9 lb. per sq.ft.; power loading, 15.9 lb. per hp.

Douglas B-7 bombardment plane

PHOTOGRAPHS have recently been released by the War Department of the new type of bombardment airplane, developed by the Douglas Airplane Company of Santa Monica, Cal. The machine is of the increasingly popular gull-wing monoplane type, powered with two Curtiss Conqueror liquid-cooled engines of 600 hp, apiece, hung outboard from the fuselage in two streamlined nacelles. Oil coolers and prestone radiators are suspended below each engine. Fuselage and tail surfaces are all metal, and wings are of the strut-brace type, fabric covered. The armament consists of machine guns fore and aft, and a complement of bombs slung beneath the fuselage.

A new model of the Bird

REFINEMENT of detail and the installation of a 170-hp. Jacobs power plant unit mark the new model C-J Bird, recently completed by the Bird Aircraft Corporation of Glendale, N. Y. Although basically similar to previous Bird models in design and construction, the changes which have been incorporated add both to its performance and its appearance.

The unit power plant idea has been well applied in the new design, with the result that the engine compartment forward of the fire wall is unusually well organized. All parts are readily accessible for inspection or adjustment, with a minimum of interference. Before final assembly, the complete engine installation is asesmbled on a dummy engine mount, and all fuel and oil lines, as well as control rods and levers are fitted to suitable jigs.

Another improvement in connection with the power plant is the placing of all fuel cocks, primers, etc. in the pilot's cockpit, instead of installing them forward and operating by push rods or levers. This arrangement puts the control of the fuel supply directly under the pilot's eyes, and eliminates trouble which sometimes occurs where remote control devices are employed.

Changes have been made in the cowling around the cockpit, to give better fuselage shape, and a new all-metal turtle-deck has been added, which incorporates a headrest extending from the rear of the pilot's cockpit to the base of the fin.

The general specifications are as follows: Length overall, 22 ft. 6 in.; height overall, 8 ft.; span (maximum), 34 ft.; total wing area, 266 sq.ft.; weight empty, 1410 lb.; useful load, 835 lb.; gross weight, 2245 lb.; wing loading, 8.45 lb. per sq.ft.; power loading, 13.2 lb. per hp.

AIRPORT MANAGEMENT

Remote control for floodlight shadow bar

USE of a shadow bar on the B.B.T. floodlight on Cleveland Municipal Airport has been regular practice for several years. Its operation has been simplified by a remote control device developed by Maj. John Berry, airport superintendent, enabling the man on duty in the control tower to handle the bar without leaving his post. The control unit consists of a horizontal rod, on one end of which is a grip similar to a pistol grip, attached to a vertical rod fixed in a horizontal wheel. Around this edge runs the wire cable which on the floodlight end runs through a series of pulleys to the base of the bar itself.

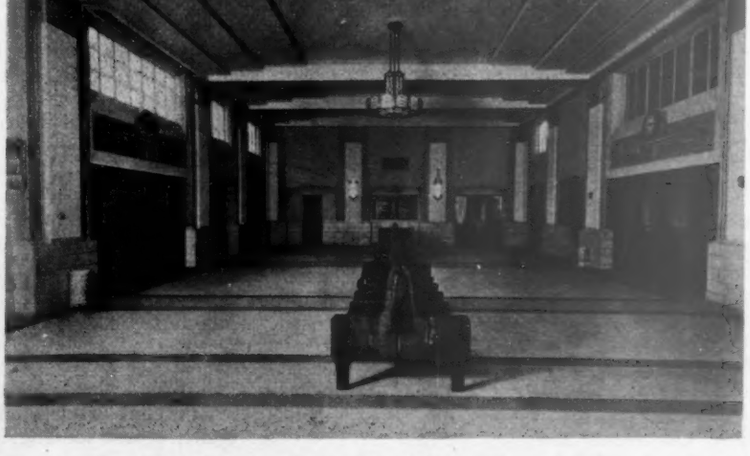
The operator merely aims the horizontal rod at the landing plane as he would aim a gun, following the plane as long as it is on the ground or close to it in landings and take-offs. The pulleys provide the proper leverage to operate the bar which is about an inch wide and as tall as the face of the light.

The shadow bar on Central Airport's B.B.T. unit. The bar is mounted on two tracks and is moved by a pulley and wire system operated manually by the attendant at the light.

The bar throws a shadow which, of course, blankets the plane and permits the pilot to see the airport surface without at any time being actually in the glare of the light. A similar bar is now successfully used at Central Airport, Camden, N. J.

Joint promotion scheme for airport billboards

THE Spartanburg (S. C.) Airport, a stop on Eastern Air Transport's Richmond-Atlanta line, has been furnished with a sign jointly advertising the company's schedule and a nationally advertised product. Such installations have been of no expense to the transport company through the cooperation of the local representative of the product advertised. This is a form of joint promotion which has been widely used in other industries.



The attractive and efficient waiting room at Tulsa Municipal Airport. Above: Eastern shares a signboard at Spartanburg Airport.

A flying field "house organ"

ROOSEVELT FIELD at Mineola, L. I., has for some time issued weekly a mimeographed four-page folder containing news items regarding the activities at the field. This has proven effective in disseminating information throughout all the companies and airport personnel and customers at the field and to many connected with the industry in the New York metropolitan area. It has been effective in keeping aviation reporters of scores of newspapers in touch with Roosevelt happenings.

The news letter has a circulation of about 350 copies which cost only about 2.5 cents per copy to prepare by the mimeograph method. Items printed include reports of interesting activities of guests and individuals stationed at the field, special operations undertaken by the Roosevelt companies or of operators located there, and other bits of "gossip" of general interest. It is in effect an airport house organ which many large airports with diversified activities might profitably emulate. The inside spread is devoted to a weekly release for the special benefit of the press. This is sent out each Monday; the front and back pages containing information more local in nature are added on Tuesday and those copies are distributed about the airport.

Waiting room at Tulsa

THE passenger waiting room at the new Tulsa Municipal Airport administration building. Much attention has been paid to the interior decorating, which includes frescoes over each main door depicting progress from old to new transportation media in the West. Airline ticket offices are located along the side of the room and administration offices are in the four-story tower.

Airline schedules are posted on the large bulletin board at the further end of the room. The exit to the field and the loading area is at the right under the clock. Writing tables are provided.

SERVICING SHORT CUTS

Emergency hoist for engine removals

FOR emergency removal or installation of engine at Eastern Air Transport shops at Byrd Field, Richmond, Va., a simple steel tube tripod crane may be installed on the emergency truck in a very short time. With this arrangement it is possible to handle both the Curtiss Conqueror engines of the Condors as well as the Whirlwinds of the Kingbirds. When the crane is not in use, the three legs may be readily dismounted, and the truck made available for other purposes.

Dope room ventilating system

AN efficient dope room ventilating system has been installed at small cost by the Airtech shops at San Diego, Cal. A large air box was built under the work bench along one side of the room, the intake being a floor-line slot 2¼ in. high and 3 ft. long, with the exhaust through a circular opening leading to a stack communicating with the outer air. An ordinary air fan was salvaged from an automobile truck and mounted so as to operate in the circular opening between the air box and the exhaust vent. Driven by a ¼-hp. electric motor this fan proved adequate to the job of ventilating a room 60x20 ft. in floor area and 12 ft. high.

When doping in this room a door at one end of the room, remote from the ventilating system, is opened slightly. With the fan operating all air sucked into the system must come directly off the floor and since all dope fumes tend to fall to the floor this method serves to keep the room well ventilated.

A schedule board for shop personnel

THE assignment of crews to repair jobs at the Pan American Airways, Inc., shops at the International Airport, 36th St., Miami, is facilitated by the use of an ingenious scheduling board. The board is ruled off horizontally and vertically with white lines. The standard servicing operations on both airplanes and engines are listed across the top, one operation opposite each vertical line. At the left hand side the names of the crews are listed, one opposite each horizontal line. The placing of a colored thumb tack at the intersection of any horizontal and vertical line indicates the assignment of that particular man to the job indicated. Provision is made to indicate which shop shift the assignment pertains. A glance at the board at any time, gives a picture of the allocation of the entire shop force.

A one-man tail skid dolly

AT Eastern Air Transport's Atlanta Repair Depot, one man handles Pitcairn Mailwings in and out of the hangar by means of a long-handled tail skid dolly. By pushing the nose of the carrier, under the tail post of the airplane and bearing down on the long handle, the tail of the machine is raised sufficiently so that the tail skid clears the ground, and the machine may be pulled easily around the hangar floor or out onto the apron.

Aviation

Above: Emergency truck and hoist. Right: A tail skid dolly at Eastern's Atlanta Repair Depot. Lower right: Pan American's personnel board.

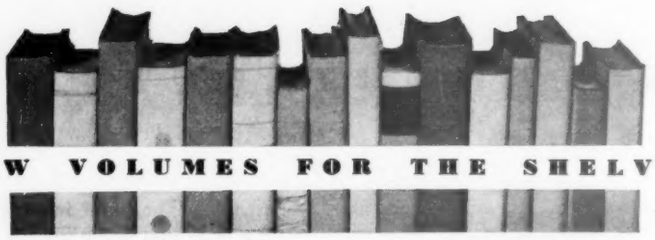
Spark plug testing apparatus

A TIME and labor saving device for testing radio shielded spark plugs has been developed in the Oakland shops of the Pacific Air Transport Company. The chief feature of the instrument is that it eliminates the screwing of plugs in and out of sockets in the test chamber, reducing the operation to simple motions of hand and foot which makes it possible to test spark plugs in almost as little time as they can be picked up and laid down by the mechanic.

The test chamber, with a glass observation window in the upper end is open at the lower end, and is fitted with a heavy rubber gasket against which the spark plug is pressed by means of a foot operated jack, effectively sealing the chamber. Air pressure is admitted by the hand operation of a valve lever. Contacts are provided for sending current through the plug when it is in place for testing and the control of electric current is accomplished by means of a button operated with the right hand.

Safety handles for wheel chocks

RIGID handles 4 or 5 ft. long, welded or bolted to wheel chocks, permit accurate adjustment at each wheel from well outside the propeller danger zone.



JANE'S ALL THE WORLD'S AIRCRAFT, 1931; *Edited by C. G. Grey and Leonard Bridgeman; Sampson Low Marston & Company, Ltd.; London; 1931; 603 pages.*

AFTER twenty years of uninterrupted publication of the annual founded by the late Fred Jane, it is almost superfluous to review it. It has become the standard reference work of the aeronautical world, to which one automatically turns whenever there is occasion to look up the characteristics of European airplanes. The present issue is as well planned, and has illustration as copious, as any of its predecessors. There is somewhat more general information than in any previous year, especially on air transport operations and on the airports of the various countries. Engines are as well covered as airplanes.

Close examination of the American section reveals only a few unimportant errors, and it proves to be surprisingly up to date. The volume arrived in the United States about Jan. 1, yet it includes information on American military types on which the first data were released in this country as late as October. The closest approach to seriously misleading information is the inclusion of four or five companies which are totally extinct.

THE AVIATION HANDBOOK, *by Edward P. Warner and S. Paul Johnston; McGraw-Hill Book Company, 1931; 715 pages; $7.50.*

HARD on the heels of the "British Handbook of Aeronautics" comes the first American attempt of the sort. It goes much less deeply into theoretical matters, but considerably farther into practical design data, than the British volume, and of course has the advantage of being prepared from the American point of view. Like other engineering handbooks, it is a compilation rather than an original production, an attempt to bring together all the most important material to which the aeronautical engineer has frequent reason to refer. Roughly speaking, 200 pages are devoted to aerodynamic data, including airfoil characteristics, parasite resistance information, performance computation methods and formulas, and equations bearing on stability and control; 100 to materials with reprints from many Army and Navy specifications; 100 to structural data, including load factor specifications for American military and commercial planes and also those of certain foreign governments, and many charts, equations and tables bearing on stress calculations; and 200 to design standards and data on equipment, including general installation drawings for all much-used American and some British engines and for a great variety of instruments, accessories, and standard parts. The volume closes with a reprinting of the Airworthiness Regulations of the Department of Commerce (Bulletin 7-A) and of the general specifications for aircraft of the United States Navy. Weight data are also given for all standard accessories and parts and weight analyses for a number of typical planes.

Since one of the authors of the handbook writes this review, it would be improper to praise the work, and the review has been confined to a listing of what the book contains. It can at least be claimed that it is an honest attempt to fill a serious gap in aeronautical literature.

UNITED STATES AVIATION REPORTS, 1931; *Edited by Arnold W. Knauth, Henry G. Hotchkiss, and Emory H. Niles; 526 pages; United States Aviation Reports, Inc.; Baltimore.*

THE law becomes ever more important in aviation, and operators of aircraft are finding that they must learn something about the law themselves instead of merely depending on advice of counsel at every point. The annual volume of Aviation Reports then can be considered as addressed to laymen as well as to members of the Bar.

From either point of view it is almost impossible to criticise the book. It is a careful and complete compilation of all decisions relating to the law of aviation in the courts of the United States and Canada, of all state and federal statutes affecting aviation, and of various opinions of attorneys general and other administrative legal authorities. There is a very careful index by subject, and the value of the work is immensely increased by a twenty-page cumulative index covering all the cases and laws recorded in the four years in which the Aviation Reports have been issued. Particularly worthy of commendation, especially from the lay point of view, is the careful summary and classification of the most important points brought out which precedes the reprinting of each decision or judicial charge.

Among the cases of particular interest covered in the present volume are the Eastern Air Transport gas tax case and the passenger liability cases resulting from the Colonial Airways accident at Newark in 1929 and the T.A.T. accident at Indianapolis late in the same year.

UPSHIP!, *by Lieut. Comdr. Charles E. Rosendahl; Dodd, Mead & Company; New York; 1931; $3; 311 pages.*

BOOKS on the rigid airship have been rare, and most of those that have been written have presented the German point of view or have related principally to war-time flying. There has been no other volume on airship operation from so competent an American source as this, because there is no other American source so competent. Commander Rosendahl writes from an unique experience.

"Upship!" is devoted largely to the recital of that experience. With brief interludes devoted to illuminating technical matters for readers not versed in airship theory and practice, Commander Rosendahl devotes 200 pages to the record of airship development as he has seen it from 1923 to 1931. It is a record that includes the first trials of the Shenandoah, that ship's wild voyage after breaking away from the mast, the final loss by storm, the subsequent career of the Los Angeles under the author's command, and the first trans-Atlantic flight and the flight around the world of the Graf Zeppelin on which he was an official observer.

Commander Rosendahl reviews the airship's prospective place in the world and the technical problems, especially those of handling on the ground. No one has done so much as he and his associates to solves those problems. Although the book is the work of an enthusiast for the airship it is written with due restraint, and it will be difficult for any reader of the forecast of the airship's future wholly to avoid infection by Commander Rosendahl's enthusiasm.

MODEL BUILDERS' MANUAL AND JUNIOR AERONAUTICAL ENGINEERING, *by Thomas L. Bulger; Dime Publications, Inc.; New York City; 64 pages; $.50.*

FOR those interested in building model aircraft, an avocation which has increased in popularity extensively in recent years, particularly among youths active in handcraft, this should be a useful handbook.

TRANSPORT

Operations and Traffic Management

Glazed windows simulate fog

CLOSE attention is paid by operations officials of Mexican division, Pan American Airways, to the proficiency of its pilots in instrument flying, because the meteorological conditions over its routes often require flying by instruments for an hour or two at a time. Like many transport companies, Mexican Aviation Company maintains, at its Brownsville base, a plane devoted to instrument flying instruction and practice. This machine, a Fairchild 71, differs from the regular model in that the rear section of the cabin, where the student is placed, is fitted with glazed windows rather than totally opaque material. The company has found that the soft grey light penetrating the "blind" cockpit through this glass approximates best the conditions encountered in actually flying through fog. No night flying is done by the company.

Travel planning bureau for business men

THE Business Travel Planning Bureau established Oct. 1 by American Airways to plan itineraries for traveling business men, utilizing airlines, railroads and other services of transportation, has to date figured out more than 3,000 trips for salesmen, sales managers, and executives of firms whose products have a national distribution. About 20 per cent of this number have actually made the trips planned and in every case the traveler has been enthusiastic about the service. The object of the bureau is to enable traveling men to get about the country losing as little business time as possible en route. If two services parallel any part of the itinerary, the one which saves most business hours is recommended and used.

A typical instance of how the bureau functions: C. S. Hamilton, president of the Hamilton Motor Car Company of Dallas, recently had business which occasioned him to visit New York and Detroit. The Dallas office of American Airways arranged all transportation for Mr. Hamilton as follows: From Dallas to Port Columbus by American Airways and from Port Columbus to New York via railroad. Returning, he was routed to Detroit over United Air Lines and Transamerican; from Detroit to Cincinnati by train and from Cincinnati to Dallas by American Airways.

The bureau is headed by a member of the traffic department and his assistant in New York City, with traffic representatives in each division specially coached in the work of coordinating schedules. The bureau is a recognized division of the traffic department.

Smoking permission approved by passengers

THE advisability of permitting smoking on passenger transports has been a moot question of policy ever since scheduled operations started. In Europe it is common practice to permit smoking, but in this country airlines have been divided on the question. Eastern Air Transport permits smoking but only on its Condor machines and there only in the forward compartment, though this rule often is overlooked when the plane is crowded and use of the compartment by all passengers wishing to smoke is impossible.

Lines forbidding smoking have been prompted chiefly by the desire to restrict what might be an annoyance to the average passenger through contaminating the air in the confined cabin, particularly in these years when many passengers are not accustomed to air travel. The small risk from fire weighs less heavily. Thus the official attitude is much the same as that of many railroads in regard to smoking in dining cars.

It is significant that National Air Transport, operating Fords between New York, Chicago and Dallas recently revoked its rule prohibiting smoking in deference to what appeared to be the prevailing opinion among its patrons. A substantial percentage of passengers have been requesting the smoking privilege and the expressions of approval greeting the change indicate that new arrangement may be considered another concession for the comfort of the greatest number.

Pan American operates a flying boat base

CAREFUL attention has been paid to passenger comfort in the terminal building now serving Pan American Airways at its new flying boat base at Dinner Key, Miami. Verranda space on both floors provides comfortable lounging accommodations for those awaiting planes. The planes are boarded from the float at the end of the barge.

The planes are boarded by both crew and passengers in accordance with bell signals controlled by the port manager from his office. This method is very successful; it systematizes the departure routine, carries out the general impression of efficient organization, and leaves no doubt in the minds of the passengers, particularly those unaccustomed to air travel, as to the proper time to appear at the passenger gate. The crew goes aboard at the first signal, the passengers are admitted at the second.

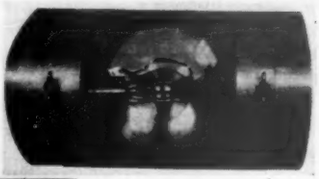
Aviation

The passenger terminal installed recently by Pan American Airways at the Dinner Key flying boat base at Miami. The loading platform is shown at the end of the float.

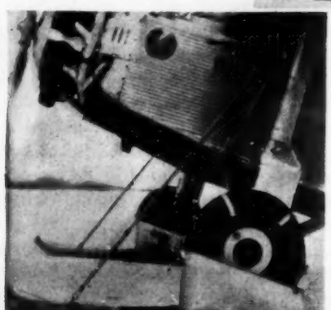
THE BUYERS' LOG BOOK

Aircraft thermometer

The Lewis Engineering Company of Naugatuck, Conn., has recently put on the market a thermocouple-type thermometer for aircraft engine use together with a selector switch to permit readings of temperature from a number of points about the engine, using one indicator. Any number of thermocouples up to 18 may be handled by the switch. Both instrument and switch are mounted in standard Army-Navy cases for instrument board mounting. Thermocouples of both the washer and the stud types are available.



Above: The Lewis thermometer. Left: General Electric wing landing light. Lower left: Federal quickly detachable ski gear



The indicator weighs 1 lb. 3 oz., the selector switch 1 lb. 4 oz., and each 12-ft. thermocouple weighs 12 oz.—AVIATION, *March, 1932.*

Landing light

The General Electric Company of Schenectady, N. Y., is marketing a type of landing light for aircraft which is installed wholly within the leading edge of the wing, thus offering no additional drag, or disturbing its aerodynamic characteristics. All moving parts are fully enclosed, and the light beams may be directed independently as desired in flight. The ordinary installation includes a 12-volt, 420-watt lamp, which gives a beam of approximately 600,000 cp.—AVIATION, *March, 1932.*

Quick detachable skiis

The Federal Aircraft Works of Minneapolis, Minn., manufacturers of skiis for aircraft, have announced a new type of ski gear which has recently been developed in conjunction with Northwest Airways, Inc. The new equipment is designed for operation where wheels and skiis must be used interchangeably, and where quick changes must be made. Ordinarily, the landing wheels must be removed for attaching skiis, but with this equipment, the skiis enclose the wheel in a metal bucket. When desired the plane can be run onto the skiis, and the wheels rigidly attached to the bucket without removing them from the axles. The change back to wheel gear is equally simple, and may be accomplished in a short time.—AVIATION, *March, 1932.*

Flexible hose

Seamless, flexible, metallic tubing of a new type has recently been placed on the market by the Bendix Aviation Corporation, for use in making fluid connections between any moving parts. Due to its seamless construction and the fact that fittings are welded or brazed onto the tube end, the possibility of leakage has been materially reduced. Protective casings of various types can be supplied to cover the flexible tubing to protect it against mechanical damage. Internal diameters of $\frac{1}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1 in. are available.—AVIATION, *March, 1932.*

Pilot's watch

An airplane pilot's watch is continually exposed to drastic temperature changes, magnetic fields, and changing moisture conditions, all of which affect its accuracy. The "992" Elinvar watch manufactured by the Hamilton Watch Company of Lancaster, Pa., has been designed to resist such unfavorable conditions.

The hair spring is made of Elinvar, a new rustless, alloy steel of invariable elasticity, which eliminates any effects of changes in temperature. It is available in the No. 16 size pocket style.—AVIATION, *March, 1932.*

Oil reclaimer

A lubricating oil reclaiming plant evolved by the Research Department of the General Electric Company, is being built by the Hilliard Corporation of Elmira, N. Y. Three sizes are available with capacities of 8, 20, and 50 gal. of oil per day. The units are self-contained and are designed to put used oil through two distinct processes, the first stage being clarification by chemical reaction and settling, and the second rectification by the application of heat at relatively low temperatures. In operation the machine is fully automatic and can be handled by ordinary labor.—AVIATION, *March, 1932.*

Catalogs

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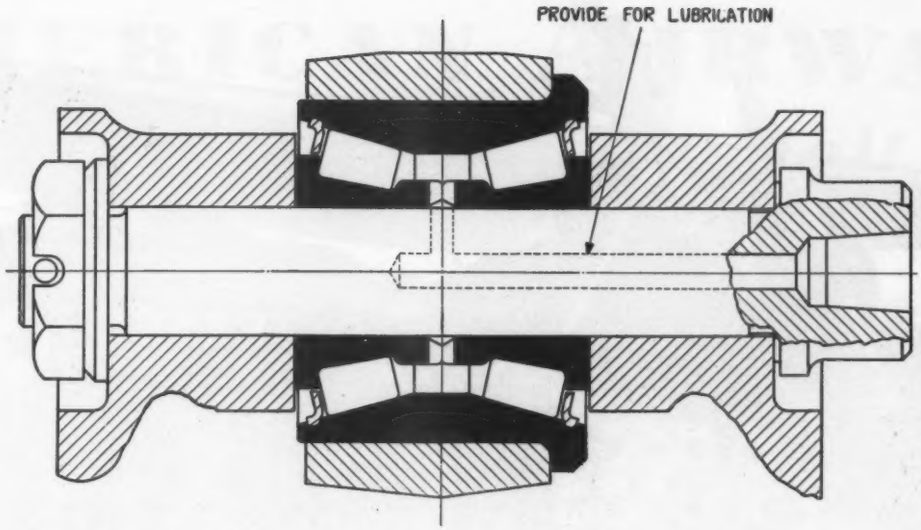
Bastian-Blessing Company — A pocket size booklet describing Rego acetylene welding and cutting equipment, has recently been published by the Bastian-Blessing Company of 240 East Ontario St., Chicago. It lists all types of welding and cutting torches, regulators, gas economizers, acetylene generators, and their various accessories.

Torchweld Equipment Company. A new booklet describing Torchweld welding and cutting equipment has been received from Torchweld Equipment Company, 24 North Carpenter St., Chicago, Ill. The bulletin is designated as "The Blue and Gold Catalog No. 31," and is available on request.

Hall-Aluminum Aircraft Corporation. A bulletin covering standardized aircraft sections and parts made from high strength aluminum alloy, has recently been issued by the Aluminum Company of American, sales agent for the Hall-Aluminum Aircraft Corporation of Buffalo, N. Y. The sections include various sizes of flanged tubing, bulb angles, pressed collars, and U sections of various forms. Extensive tables giving the section properties of the foregoing are also included.



NOW—Timken Bearings for Rocker Arms

Here is a rocker arm bearing that will give you the longer bearing life and more dependable rocker arm performance you have been wishing for.

Over 1,000 hours of service have been obtained from Timken Rocker Arm Bearings—and they are still going strong. What the *ultimate* life of the Timken Rocker Arm Bearing may be only time can tell.

LONGER LIFE. The tendency to "brinnell", or groove, under operating loads is one of the chief reasons for the comparatively short life of other types of anti-friction bearings in rocker arms. Timken Bearings have long life due to the line contact of the rolls, Timken tapered construction and Timken-made steel.

POSITIVE LUBRICATION. The design of the Timken Rocker Arm Bearing assures an adequate supply of lubricant under all conditions. A high level of lubricant is maintained in the load zone where it is most needed. Tight closures keep the grease in and the dirt out.

A UNIT BEARING—COMPLETELY SELF-CONTAINED. The Timken Rocker Arm Bearing is truly and completely self-contained. The double row of rolls, inner and outer races and closures are assembled to form a compact unit. It is easy to install and can be removed for inspection, or replaced when necessary, in much less time than is required for other types.

PERMANENT ROCKER ARM ALIGNMENT ASSURED. The ability of the Timken Bearing to carry thrust as well as radial loads, combined with the line contact of the rolls, overcomes the tendency of the push rod action to produce lateral wear and looseness. Thus accurate rocker arm operation is maintained throughout the life of the bearing.

The Timken Rocker Arm Bearing has already been adopted by one prominent aircraft engine manufacturer. Others are considering its adoption.

It will pay you to specify Timken-equipped rocker arms when buying new aircraft engines. The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN *Tapered Roller* **BEARINGS**

TEXACO AVIATION GASOLINE

—tuned to your engine's best

EVERY PILOT knows when he has an aviation gasoline that gives him the best in aircraft engine performance. There's the certainty of power, new speed and the feeling of complete dependability in the engine and its work.

That is Texaco Aviation Gasoline. And it is for these reasons that Texaco is so well and favorably known throughout the entire aviation industry—used and recommended by pilots in every section of the country.

Texaco Aviation Gasoline is made to advanced specifications which insure the highest efficiency as an engine fuel. A special crude is used—the most favorable for the manufacture of aviation gasoline—and the manufacture is centered in one Texaco refinery giving absolute control of every step of the process and final uniformity of the product.

Wherever you get it, Texaco Aviation Gasoline is always the same. Complete national distribution makes it available at airports everywhere throughout the United States.

Texaco is a pioneer in developing better aviation fuels and lubricants. Write The Texas Company for information on Texaco Aviation Gasoline and Texaco Aviation Products.

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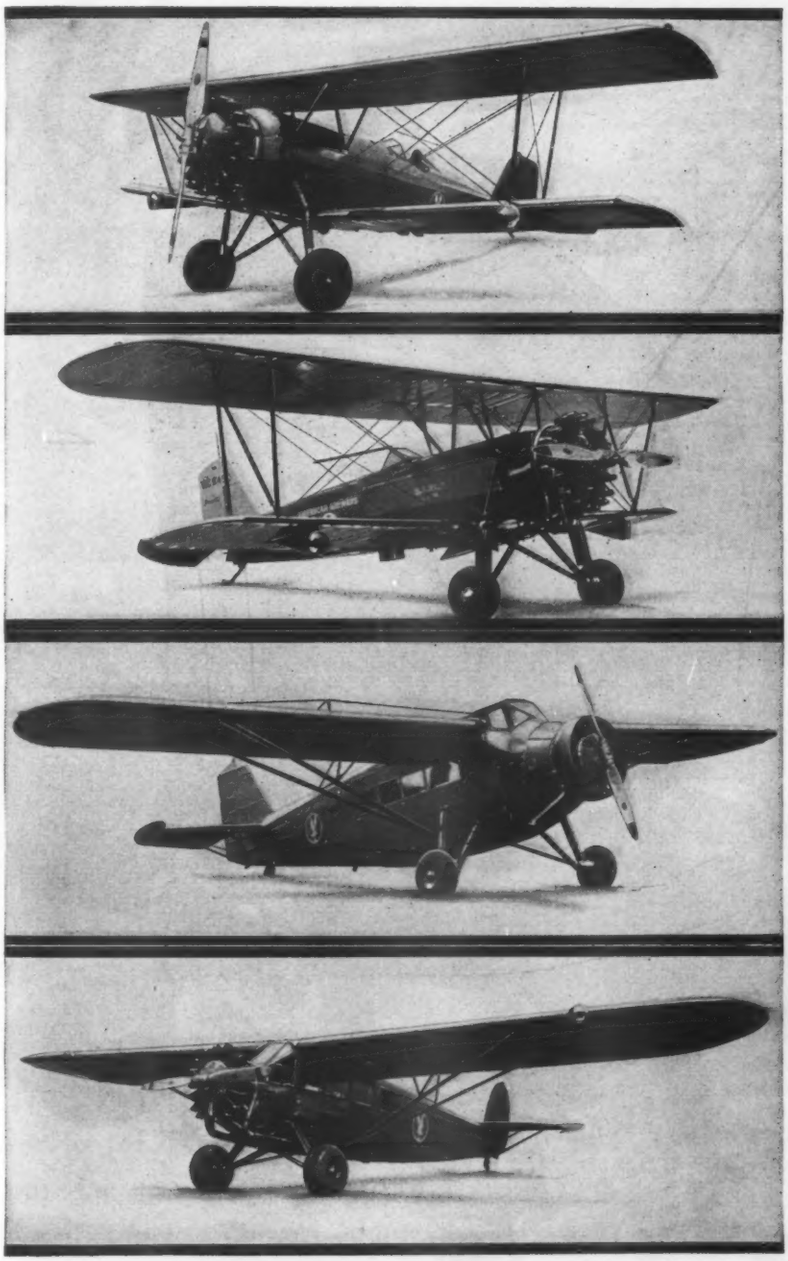
TEXACO AVIATION GASOLINE
TEXACO AERODIESEL FUEL
TEXACO AIRPLANE OILS
TEXACO MARFAK GREASES
TEXACO ASPHALT PRODUCTS
FOR RUNWAYS, HANGAR FLOORS AND APRONS, AND DUST LAYING

AMERICAN AIRWAYS
USES AIRWHEELS *on Mail and Passenger Ships*



Here are four different types of ships equipped with Airwheels, and there are many more with this same equipment in the great fleet of American Airways, with its scheduled flights of 28,826 miles per day.

With these great, yielding rolling cushions on their landing gear, planes have a new independence over ground conditions, because they can land safely in mud, sand and soft terrain where any other type of equipment would make landings hazardous.

More than this, they reduce maintenance costs, protect planes from many repair charges, such as damage due to ground loops, and give passengers a new feeling of comfort and security in landing and taxiing.

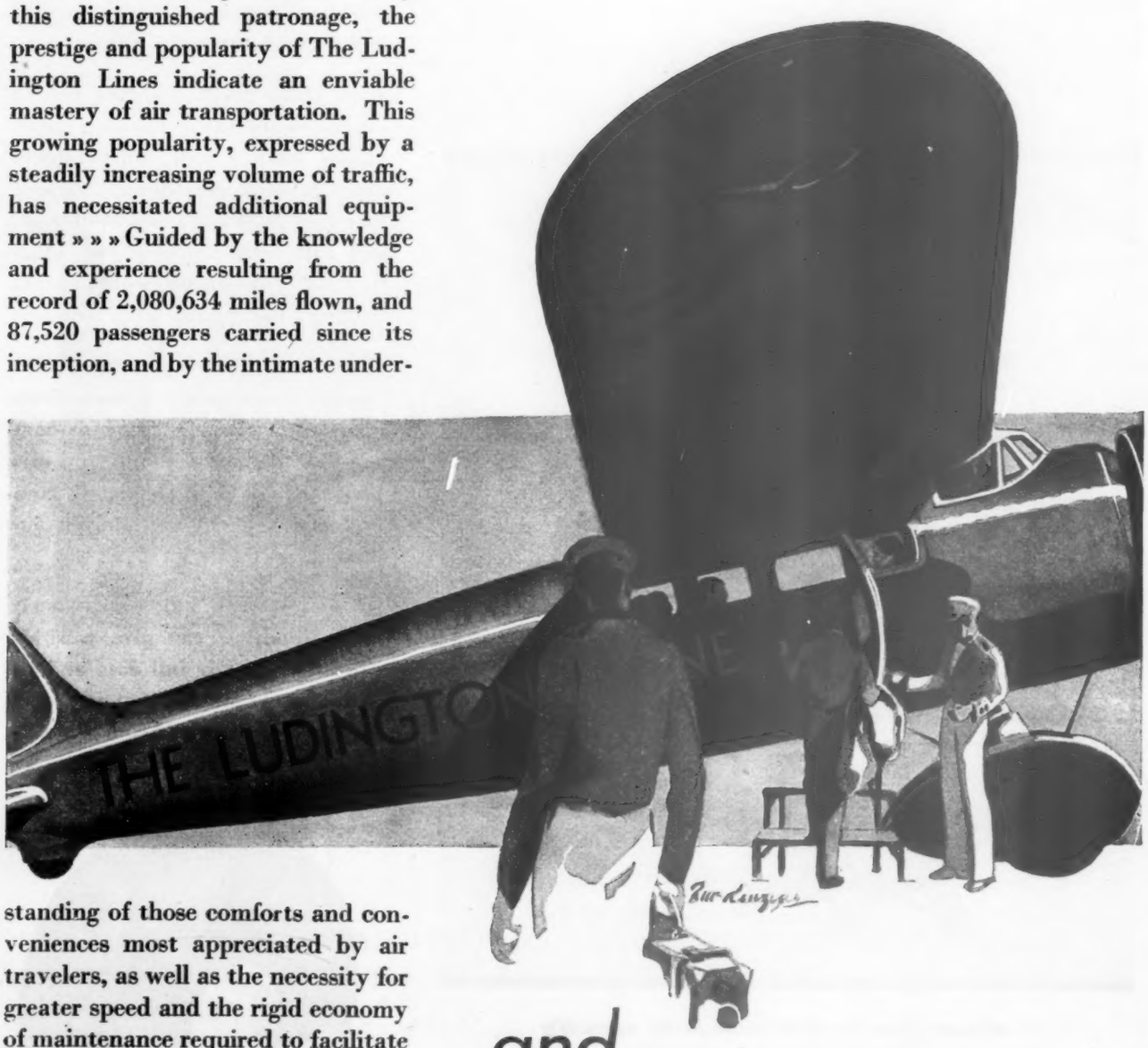
Only Goodyear builds Airwheels. Only Goodyear can give you Airwheel safety. For full data and engineering recommendations, write or wire Goodyear, Akron, Ohio, or Los Angeles, California.

When you buy a new ship specify Goodyear Airwheels

GOODYEAR

EVERYTHING IN RUBBER FOR THE AIRPLANE

SINCE September 1930 The Ludington Lines' *every hour on the hour* New York, Philadelphia and Washington service has become the accepted mode of travel by business executives and men of affairs. In serving so successfully this distinguished patronage, the prestige and popularity of The Ludington Lines indicate an enviable mastery of air transportation. This growing popularity, expressed by a steadily increasing volume of traffic, has necessitated additional equipment » » » Guided by the knowledge and experience resulting from the record of 2,080,634 miles flown, and 87,520 passengers carried since its inception, and by the intimate understanding of those comforts and conveniences most appreciated by air travelers, as well as the necessity for greater speed and the rigid economy of maintenance required to facilitate profitable transport operation . . . The Ludington Airlines, Inc.—with the equipment of the world's markets available — chose THE FLEETSTER.



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THE FLEETSTER

CONSOLIDATED AIRCRAFT CORPORATION · BUFFALO · N · Y ·

Hawaii
TRAVELS DE LUXE

Stanavo-fueled planes of Inter-Island Airways link all Hawaii with a regular monthly flying schedule of 23,000 miles.

The unique, well-established and efficient service of Inter-Island Airways is no less popular among the people of Hawaii than among tourists. Organized but two years ago, its four amphibions and one single-motored cabin monoplane have carried over 25,000 passengers 600,000 miles. Its schedules have been maintained with practically one hundred per cent regularity.

Like many other lines in the Americas, Europe, and elsewhere, Inter-Island Airways finds Stanavo Aviation Gasoline best suited to its requirements, and uses it exclusively.

STANAVO
AVIATION GASOLINE AND ENGINE OIL

STANAVO SPECIFICATION BOARD, Inc.
Organized and Maintained by

Standard Oil Company of California
225 Bush St., San Francisco

Standard Oil Company (Indiana)
910 So. Michigan Ave., Chicago

Standard Oil Company of New Jersey
26 Broadway, New York City

with an ear to the ground!

Exide Aircraft Batteries keep watch over radio . . . make messages certain

WHEN "soup" swallows up the sun—blots out beacon lights—that's when radio and position (navigation) lights must be shipshape.

Exide Aircraft Batteries protect these vital parts . . . give reliable current at all times.

What's more, they're built to fly. Ask your pilot friends. They'll tell you that Exides are light and compact, that the electrolyte will not spill, that they are safe and reliable — that Exide Aircraft Batteries last longer.

We'll be glad to tell you more about the many types of Exide Aircraft Batteries. Just drop us a note today.

SEND IT VIA AIR MAIL

During the entire 14 years in which the air mail services have been in operation, less than .0005 of 1 per cent of mail has been destroyed.

Dependable Exide Aircraft Batteries, standard equipment on most mail and transport ships, contribute to safety factors.

Exide
AIRCRAFT BATTERIES

Contractors to the U. S. Army and Navy

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE
Exide Batteries of Canada, Limited, Toronto

SPEEDY Ground Work

Caterpillar Tractor Co., Peoria, Ill., U.S.A.
Track-type Tractors Road Machinery
Combines

(There's a "Caterpillar" Dealer Near You)

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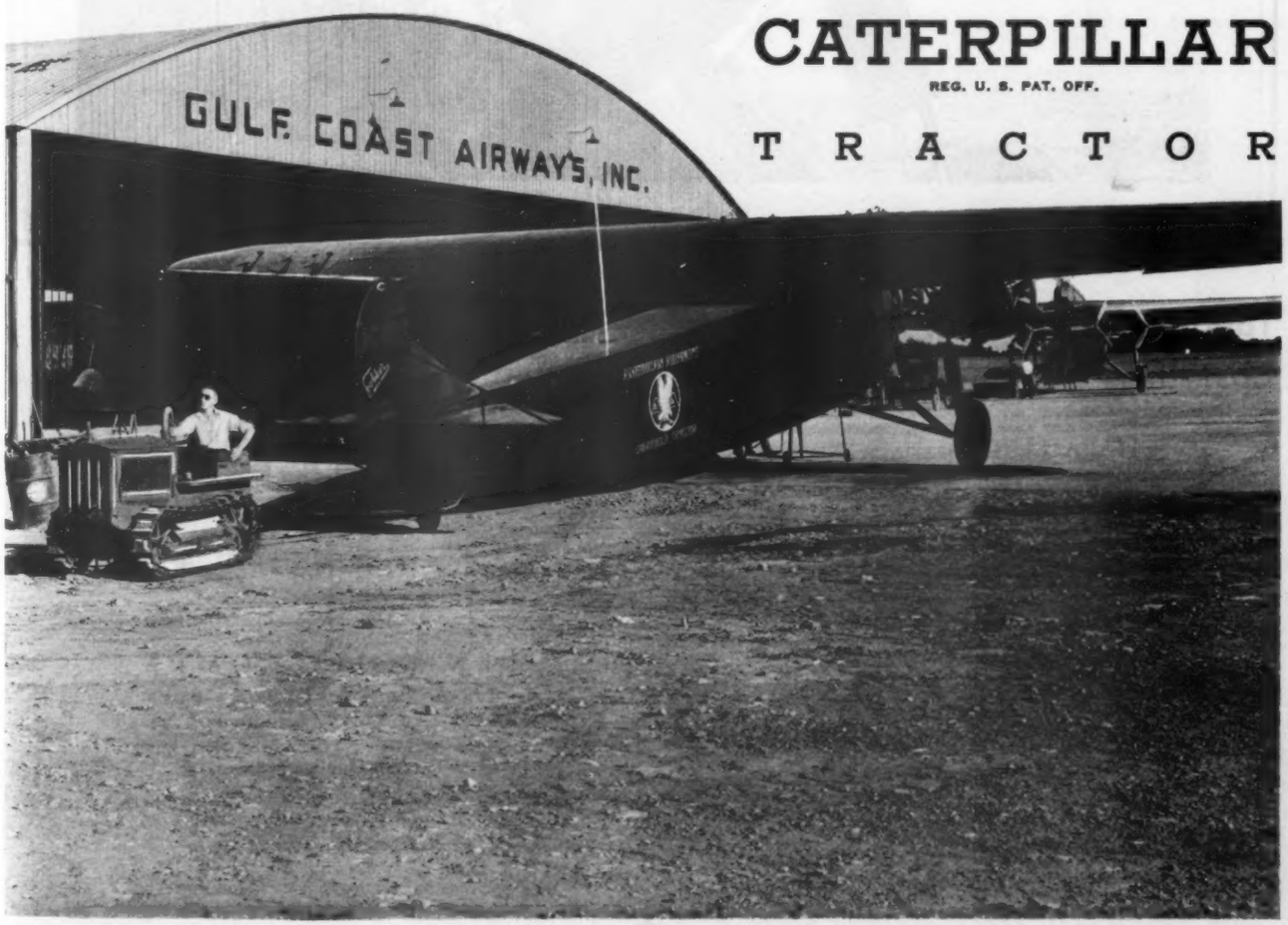
Prices — f. o. b. Peoria, Illinois

TEN	$1100	THIRTY	$2375
FIFTEEN	$1450	THIRTY-FIVE	$2675
TWENTY-FIVE	$1900	FIFTY	$3675
SIXTY	$4175		

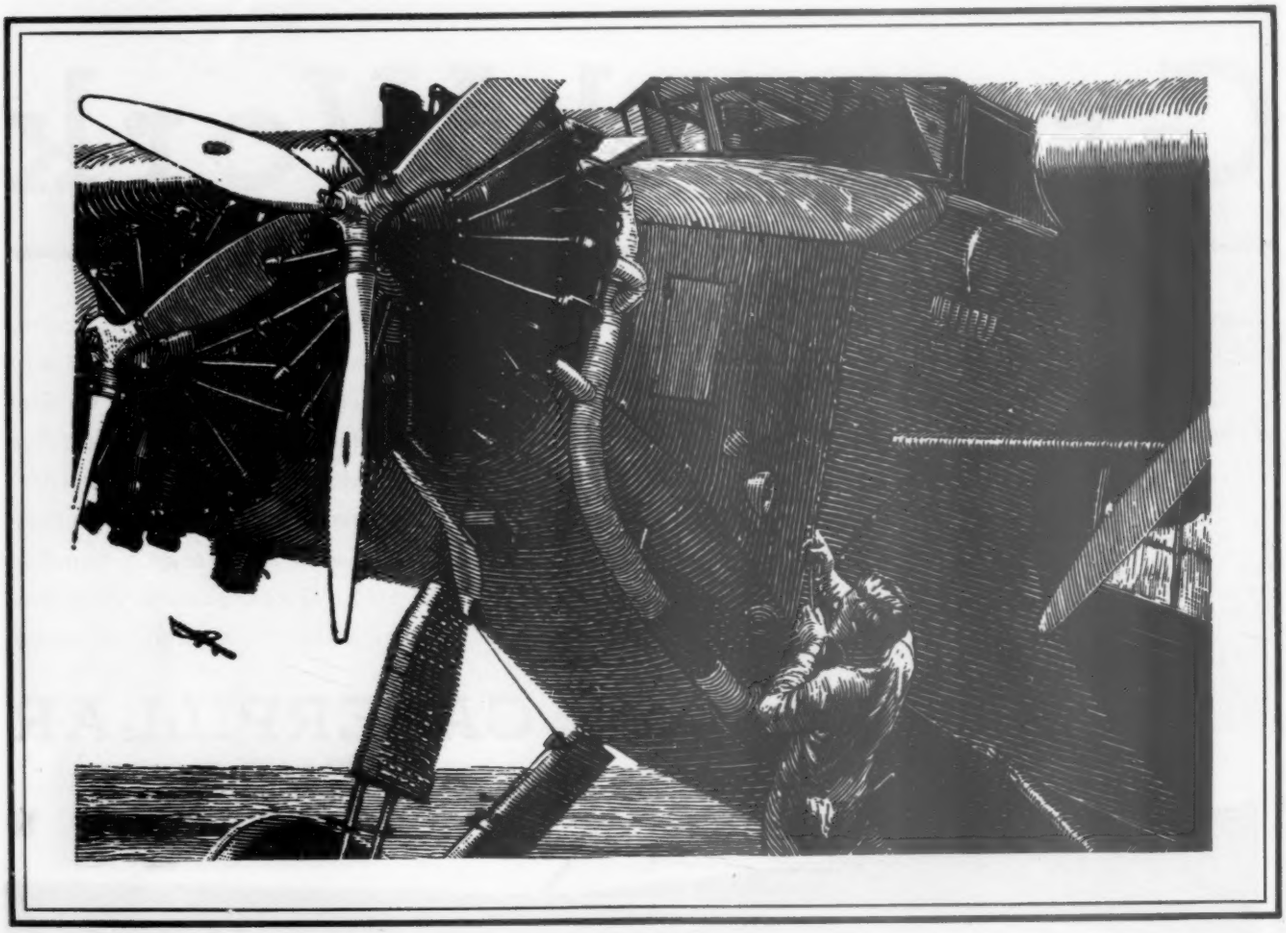
MODERN planes provide speedy transportation. And modern tractors — "Caterpillar" Tractors — put speed and orderliness into the ground work. The picture below was taken at Candler Field, Atlanta, Georgia — a similar one could have been taken at scores of other airports, large or small. With a "Caterpillar" on the job, outgoing ships are smartly, easily swung into position on the runway — incoming ones are promptly trundled into the hangars. Pilots and public alike appreciate the power facilities and efficiency of airports "Caterpillar"-equipped.

CATERPILLAR
REG. U. S. PAT. OFF.
TRACTOR



OIL FAILURE *Destroys Motors*

Cuts Power »» Causes frequent costly overhauls



Tough-Film Pennzoil cuts repairs—
Costs less per hour of flying time

OIL FAILURE starts when heat thins out poor oil. It leaves moving parts unprotected. It damages every wearing surface—cuts down r. p. m.—wastes power and causes frequent overhauls.

Because Tough-Film Pennzoil is double-refined, it flows freely, yet maintains a safe, tough film at any engine temperature. It penetrates easily into close-fitted bearings, gives protection that increases the period between overhauls. It gives more flying hours between fillings, at lower cost per hour.

100% PURE PENNSYLVANIA
PENNZOIL
SAFE LUBRICATION

Permit No. 2—*Pennsylvania Grade Crude Oil Ass'n*

THE PENNZOIL COMPANY
Executive Offices and Refinery: Oil City, Pa.
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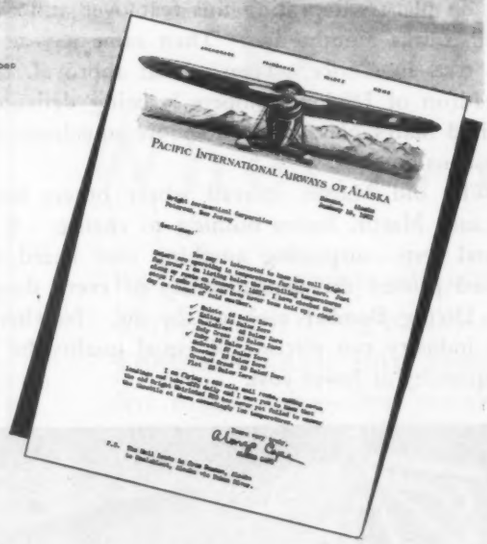
PENNZOIL *is made by the famous Pennzoil Process from 100% pure Pennsylvania crude and nothing else*

RADIO: *Enjoy The Pennzoil Parade every Sunday evening over nationwide Columbia Network*



WRIGHT
. . . . ENGINE
PERFORMANCE *at*
50° *below* ZERO

PACIFIC INTERNATIONAL AIRWAYS OF ALASKA operate a mail route between Nenana and Unalakleet, via the Yukon River. Wright-powered planes are flown daily, over this route, in temperatures ranging from 40° to 60° below zero—*but let Pilot Cape tell the story.*

" . . . You may be interested to know how well Wright Motors are operating in temperatures far below zero. Just for proof I am listing below the prevailing temperatures along my route on January 7, 1932. I have checked the stops I make daily, and have never been held up a single day on account of cold weather.

"I am flying a 400 mile mail route, making seven landings and take-offs daily, and I want you to know that the old Wright Whirlwind 300 has never yet failed to answer the throttle at these exceedingly low temperatures."

Nulato	46 Below Zero	Ruby	50 Below Zero
Kaltag	55 Below Zero	McGrath	57 Below Zero
Unalakleet	42 Below Zero	Tacotna	53 Below Zero

Wright Engines power millions of miles of transport travel every year. Their dependability under the trying conditions of intense heat and severe cold has made Wright the choice of air mail and passenger operators around the world.

Contractors to the Governments of the World

CURTISS
Conqueror and
Challenger

WRIGHT
Cyclones and
Whirlwinds

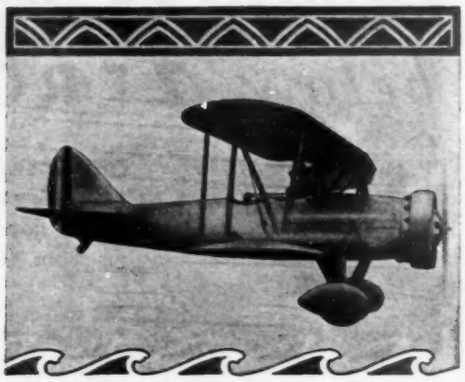
WRIGHT
AERONAUTICAL CORPORATION
PATERSON NEW JERSEY

A DIVISION OF CURTISS-WRIGHT CORPORATION

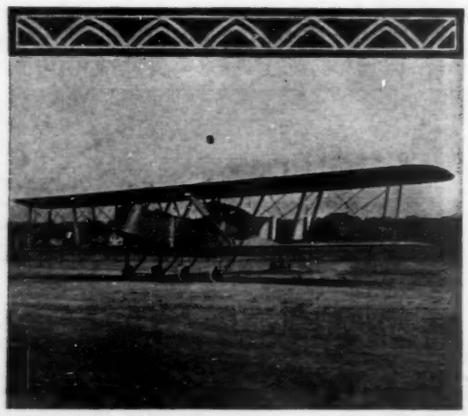
★ ★

Three Squadrons of Diving Bombers Now Being Built for U. S. Navy

New type plane, developed by Martin, heralds a new era in aerial tactics



Setting new records for bombing plane performance, the swift new Martin Diving Bomber performs loops, rolls, Immelmans, inverted flying and other aerobatics heretofore expected only of pursuit planes.

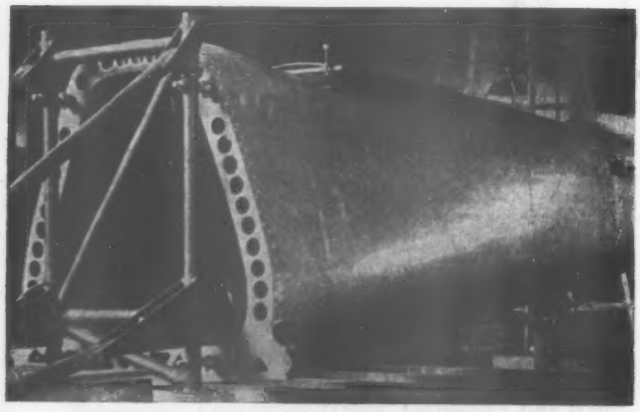


The first Martin Bomber, built in 1918, and perhaps the most famous plane of its time. This forerunner of a long line of Martin Bombing Planes presents a striking contrast to the agile new Diving Bomber of today.

SEVERAL attempts had been made. But no plane ever built before could withstand the terrific strain imposed upon the Martin Diving Bomber in its initial test flights. Diving vertically from a height of 12,000 feet with a 1,000 pound bomb slung beneath the fuselage. Attaining a speed of more than four miles per minute. Pulling out sharply from the dive with the bomb still in place. Repeating this feat over and over again.

That was months ago. Then came a year of rigorous tests in service. Then official approval. Now one squadron of Diving Bombers is being delivered to the United States Navy and two more squadrons are under construction.

Why did Martin succeed where others had failed? Because Martin leaves nothing to chance. A series of brutal tests—surpassing anything ever heard of before—had proved the dependability of every detail before the Diving Bomber took to the air. Nowhere else in the industry can aircraft of equal quality be produced in quantity at lower cost.



Typical of the care which produced the Diving Bomber, a complete reinforced shell-type fuselage was built and tested to destruction. The first scientific test of a full-sized metal-shell body in America.

MARTIN
Builders of
Dependable Aircraft Since 1909

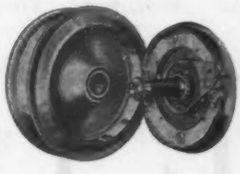
The Glenn L. Martin Company
Baltimore - Maryland
AIRCRAFT

nimble feet

BENDIX
Wheels and Brakes

Keeping ground efficiency abreast with flying ability are Bendix Wheels and Brakes for airplanes—the pioneer product of its kind; the nimble feet of modern aircraft.

They fully express the Bendix enthusiasm for quality leadership, for progressive development.



Easier control, better maneuverability, greatly increased safety, reduced take-off runs, simplified landing — all these advantages are built into this equipment.

The line is complete; types with roller-bearing wheels (a Bendix development); and low-pressure wheels.

BENDIX BRAKE COMPANY
SOUTH BEND, INDIANA
(Subsidiary of Bendix Aviation Corporation)

BENDIX FOR AIRPLANE WHEELS and SAFETY **BRAKES**

FULLY PROTECTED BY PATENTS AND APPLICATIONS IN U. S. AND ABROAD

Air Mail Saves Time

Boeing training is built on flying 37 million miles with the Air Mail

THE EQUIVALENT of 1480 around-the-world flights, all on its own affiliated air lines, in addition to one million miles of student instruction flying, is an incalculable advantage to be brought you by your flying school.

It means that your training, from the ground up, will be built on *facts*.

Boeing School of Aeronautics has a larger regular enrollment than any other recognized school. Its fleet of eight training planes includes the famous Boeing 40-C2, the eight-place Hamilton all-metal cabin monoplane, Stinson Junior cabin monoplane, the Boeing 81 trainer, the new Stearman trainer, and the famous Boeing 203 trainer—powered with motors ranging from 165 H. P. to 425 H. P. It comprises the most modern laboratories, class-rooms and shops ever grouped in one school. Located in California, on the famous Oakland Municipal Airport, it has the advantage of all-year flying weather.

The Boeing School is definitely built to meet the *future* of aviation, backed by the manufacturing and transport organization with the world's largest stake in that future. From the start, it will pay you to turn this standing to your own advantage.

A bulletin of courses, costs and facilities will be mailed you upon request. Compare our courses with those offered elsewhere before choosing your school.

Next regular enrollment, April 4, 1932

BOEING
SCHOOL OF AERONAUTICS

Subsidiary of United Aircraft & Transport Corp.

BOEING SCHOOL OF AERONAUTICS
Room B-3, Airport, Oakland, California

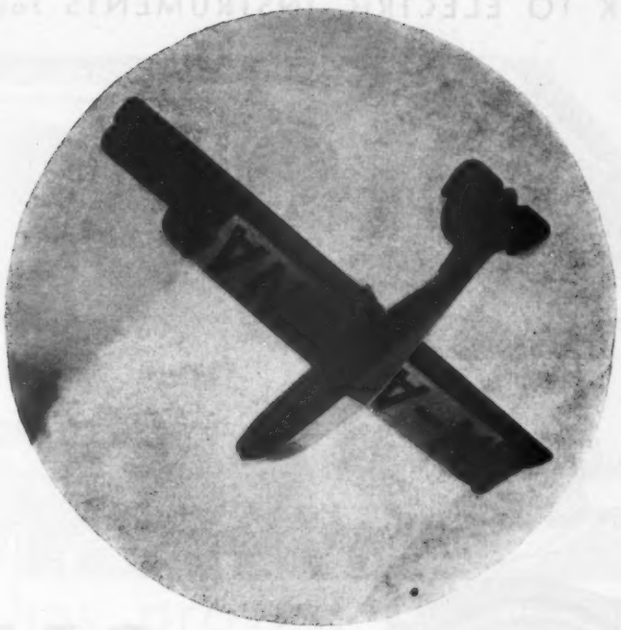
Gentlemen: I am interested in

- ☐ Private Pilot
- ☐ Limited Commercial Pilot
- ☐ Transport Pilot
- ☐ Boeing Master Pilot
- ☐ Boeing Master Mechanic
- ☐ Special Master Pilot (For Transport Pilots)

Name _____ Age _____

Address _____

City _____ State _____



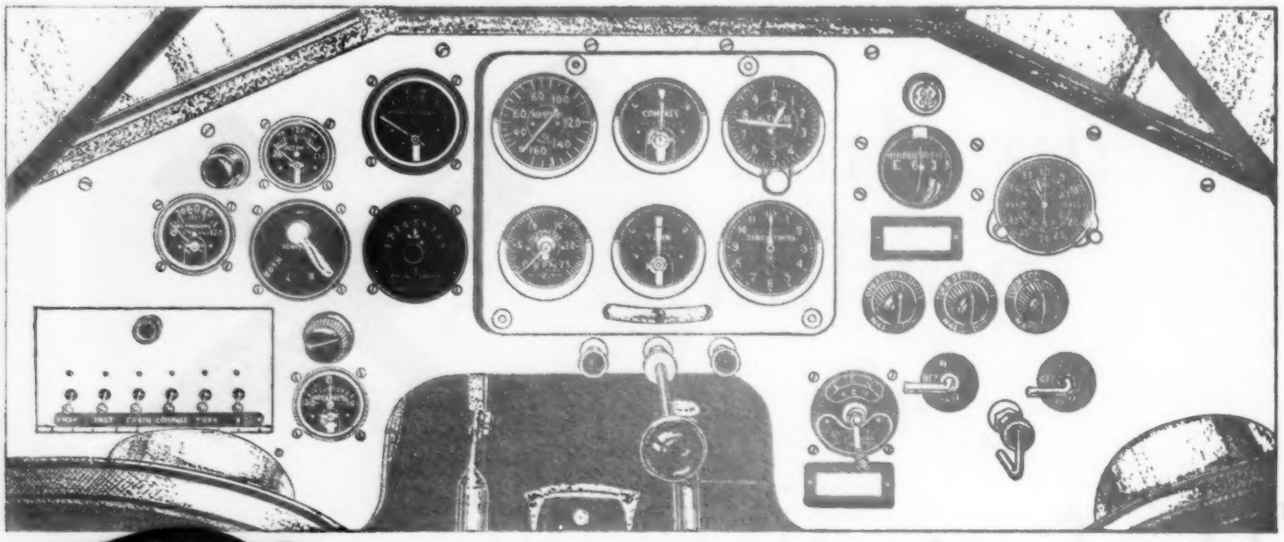
The first BOEING flying boat outlasted *seven* engines*

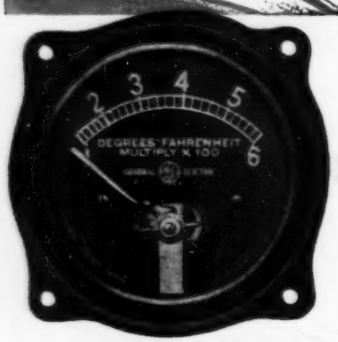
After nine years of air mail service between Seattle and Victoria—1919 to 1928—totaling more than 500,000 miles, this staunch ancestor of later commercial models was *still* in air-worthy condition — another instance of Boeing construction years ahead of its time. . . . Boeing Airplane Company, Seattle, Subsidiary United Aircraft & Transport Corporation.

BOEING

***BOEING**
has *always* built
***to-morrow's* airplanes**
TO-DAY

LOOK TO ELECTRIC INSTRUMENTS for PERFORMANCE at LOW COST





Here are the G-E engine-temperature indicator and selector switch. By means of the latter, the pilot can read individual cylinder temperatures on the dial of the indicator.

The G-E Engine-Temperature Indicator and 9-Cylinder Selector Switch

The cylinder temperature of an air-cooled engine is not the temperature of the lubricating oil. Unlike the conditions in a liquid-cooled engine, heating or cooling may take place at a high rate without a corresponding response of oil-temperature instruments. Therefore, the G-E engine-temperature indicator has an important function, for it measures accurately and instantaneously the temperature of any "hot spot" such as a cylinder wall or head. It consists of an indicating instrument connected by small twin-conductor leads to a thermocouple washer used as a spark-plug gasket. This instrument is accurate and reliable; it automatically corrects for changes in air temperature, so that you can be certain of correct readings regardless of altitude or the temperature of the surrounding air. It requires no battery and is not connected to the ignition system. Ask for Bulletin GEA-1187C. Address General Electric Company, Schenectady, New York

GENERAL ELECTRIC

AËRONAUTIC EQUIPMENT

700-17

SPECIALISTS IN NEW YORK, WASHINGTON, DAYTON, AND LOS ANGELES

THE TAYLOR CUB

A ship that has proved itself

THE TAYLOR "CUB" has proved its worth in student instruction and private flying and fills an obvious need in Aviation. The low price of $1325 opens an enormous market heretofore untouched. It is the most outstanding value ever offered—a real airplane with full size, comfortable, draft-proof cockpit, low pressure tires and standard instruments, built for strength and performance, perfectly stable in every maneuver and an honest landing speed of 26 miles an hour. For these reasons, the TAYLOR "CUB" stands alone in a class which it has made for itself. A full quality airplane for less than $1500—much less. It is the common sense plane for flying school, flying club, and pleasure flyer alike. Dealers and distributors, don't pass this opportunity by. It is your chance to show a big profit for 1932. Some valuable territory still open. Write or wire at once. Let us help you get under way before the Detroit Show and make the most of 1932.

- Excellent Vision
- Easily Accessible
- Convenient
- Comfortable
- A. T. C. No. 455

$1325 FLYAWAY FIELD

with Continental A-40 Engine

FLY *Taylormade* AIRPLANES

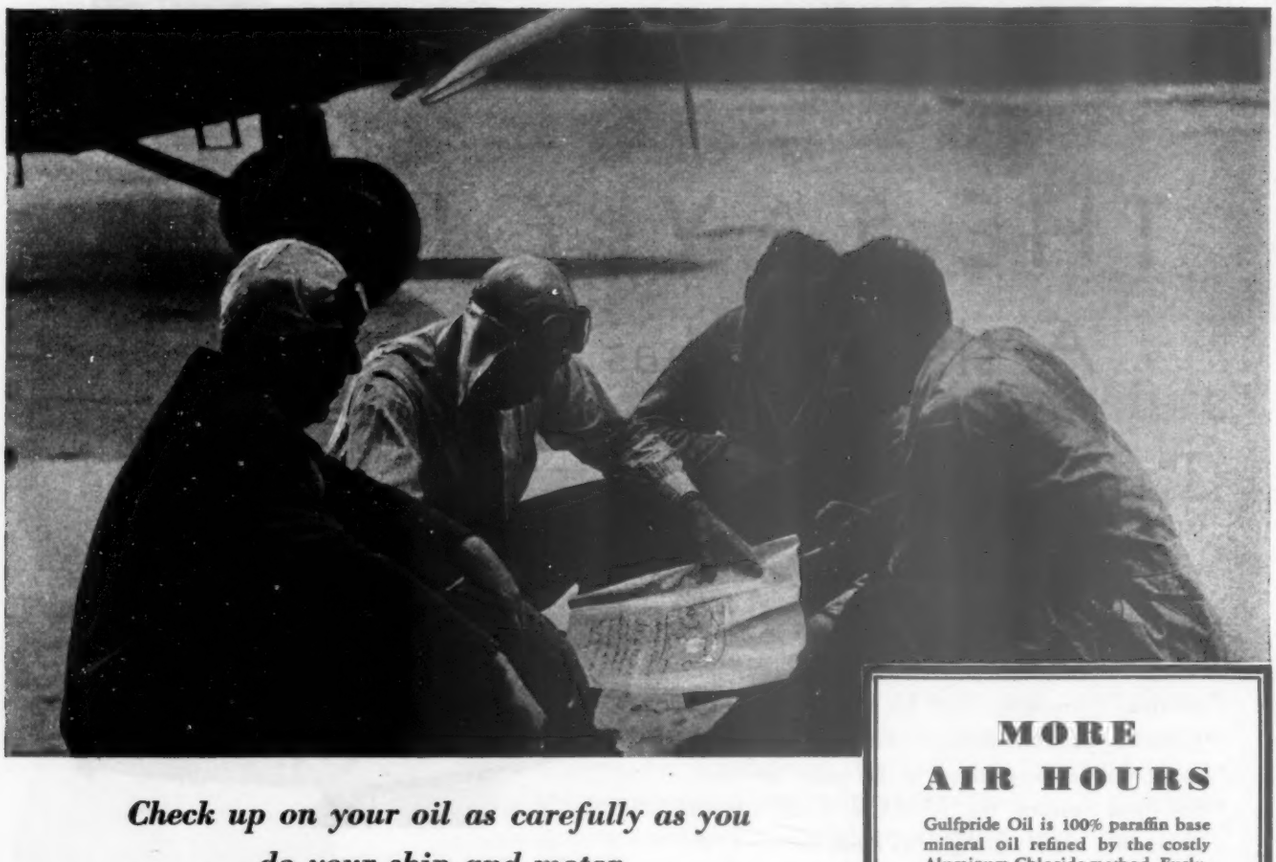
TAYLOR

AIRCRAFT COMPANY

Bradford, Pennsylvania

Do a little

"GROUND FLYING"



Check up on your oil as carefully as you do your ship and motor

TALK to the pilot who uses Gulfpride Oils and he will tell you that his experience squares with the findings of leading aviation engineers.

Gulfpride Oils show remarkably flat viscosity-temperature curves...they hold their body under high operating temperatures, yet they never become stubbornly stiff and tacky at low starting temperatures. Gulfpride Oils don't foul up the motor with carbon. Gulfpride Oils give you more power from your motor.

Technical men could tell you that Gulfpride Oils are refined by the Aluminum Chloride process, which employs materials costing $100 per ton instead of the $10 per ton acids commonly used.

That explains why pilots who demand the best in lubricants use Gulfpride Oils.

MORE AIR HOURS

Gulfpride Oil is 100% paraffin base mineral oil refined by the costly Aluminum Chloride method. Exclusive to Gulfpride. Gulfpride Oil exhibits a relatively flat viscosity-temperature curve; high flash and fire values, and low pour tests.

Gulfpride Oil holds its body exceptionally well at high operating temperatures. It is highly resistant to oxidation and emulsifying action.

Gulfpride Oil is made in five viscosities: 75—100—120—150 and 200 at 210° F, providing a superior lubricant for all types of aircraft motors, under all operating conditions.

Ask for Gulfpride Oil and you'll never be grounded because of oil-caused trouble.

Gulfpride Oil

GULF REFINING COMPANY
General Sales Offices, Pittsburgh, Pa., U. S. A.

GULF

• GULF REFINING COMPANY •

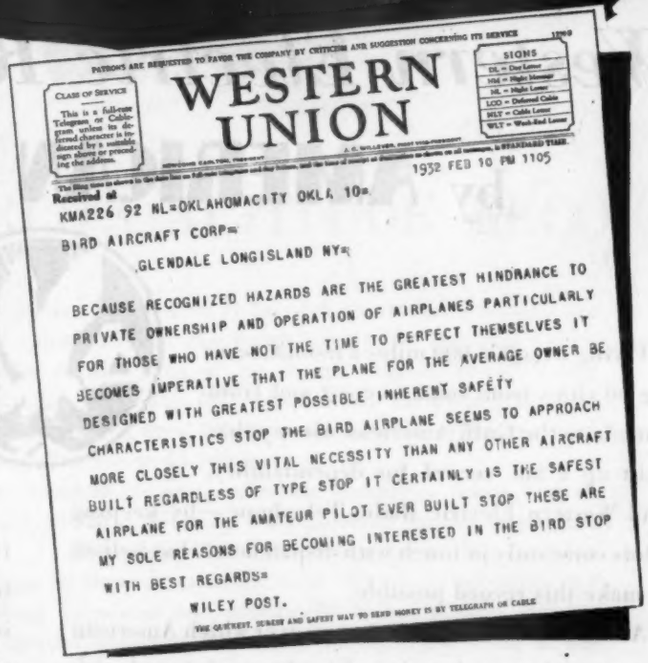
ANOTHER FAMOUS PILOT

selects the BIRD

Wiley Post (who with Harold Gatty holds the record for the fastest flight around the world) taking delivery of his new 4-place, 125 H.P. *Kinner-Bird. Wiley Post is the new Bird distributor for Oklahoma and Texas.

In addition to our present authorized dealers and representatives CURTISS-WRIGHT FLYING SERVICE, INC., has selected the Bird plane as being best in its class and has been authorized to represent us on Sales and Service throughout the United States through their thirty branches and 385 dealers.

(*The individual cylinder head streamlining shown above is special equipment.)



PATRONS ARE REQUESTED TO FAVOR THE COMPANY BY CRITICISM AND SUGGESTION CONCERNING ITS SERVICE

WESTERN UNION

SIGNS
DL = Day Letter
NM = Night Message
NL = Night Letter
LCO = Deferred Cable
WLT = Cable Letter
WLT = Week-End Letter

CLASS OF SERVICE
This is a full-rate Telegram, or Cable-gram unless its de-ferred character is in-dicated by a suitable sign above or preced-ing the address.

1932 FEB 10 PM 1105

Received at

KMA226 92 NL=OKLAHOMACITY OKLA 10=

BIRD AIRCRAFT CORP=

GLENDALE LONGISLAND NY=

BECAUSE RECOGNIZED HAZARDS ARE THE GREATEST HINDRANCE TO PRIVATE OWNERSHIP AND OPERATION OF AIRPLANES PARTICULARLY FOR THOSE WHO HAVE NOT THE TIME TO PERFECT THEMSELVES IT BECOMES IMPERATIVE THAT THE PLANE FOR THE AVERAGE OWNER BE DESIGNED WITH GREATEST POSSIBLE INHERENT SAFETY CHARACTERISTICS STOP THE BIRD AIRPLANE SEEMS TO APPROACH MORE CLOSELY THIS VITAL NECESSITY THAN ANY OTHER AIRCRAFT BUILT REGARDLESS OF TYPE STOP IT CERTAINLY IS THE SAFEST AIRPLANE FOR THE AMATEUR PILOT EVER BUILT STOP THESE ARE MY SOLE REASONS FOR BECOMING INTERESTED IN THE BIRD STOP WITH BEST REGARDS=

WILEY POST.

THE QUICKEST, SUREST AND SAFEST WAY TO SEND MONEY IS BY TELEGRAPH OR CABLE

The BIRD CHALLENGE *for* 1932

The most advanced and reasonably-priced line of open cockpit airplanes in which have been incorporated over fifty recent improvements.

Bird planes invite comparison in performance with any others in their power range—including planes equipped with rotor vanes, slots, flaps or variable camber wings.

All Bird planes may now be purchased on liberal terms. Write for full information.

SEE THE COMPLETE BIRD LINE AT THE DETROIT SHOW, APRIL 2-10, 1932

BIRD AIRCRAFT CORPORATION, Glendale, L. I., New York

BIRD

THE SAFE AIRPLANE

110 planes 34 ground stations . . .

equipped with *Western Electric Radio Telephone*

by AMERICAN AIRWAYS *Inc.*

Flying over 875,000 miles a month, serving 60 cities from coast to coast and from Canada to the Gulf, American Airways has built up a fine record for dependability. And Western Electric Radio Telephone—by keeping pilots constantly in touch with dispatchers—has helped to make this record possible.

Along the 9,387 miles of airways over which American operates, 34 ground stations have been equipped with Western Electric Radio Telephone apparatus for guiding and instructing pilots en route. And 110 planes are Western Electric equipped—63 for two-way Radio Telephone communication, 47 for receiving radio beacon signals and Department of Commerce weather broadcasts.

There's Western Electric Radio equipment designed for small planes, too — light, compact and easily installed. For details, write to Western Electric Company, Department 270A, 195 Broadway, New York.

Western Electric equipped routes of American Airways, Inc.

*Western Electric**

Aviation Communication Systems

MADE BY THE MAKERS OF BELL TELEPHONES

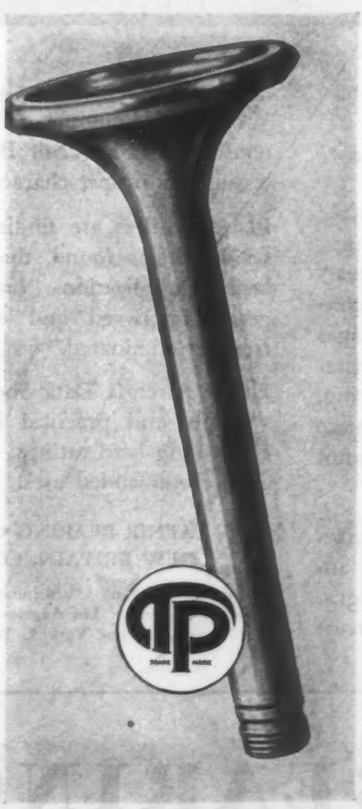
**Northern Electric in Canada*

FAMOUS FLIGHTS WITH THOMPSON VALVES

8 MILES UP

This advertisement is one of a series recalling historic airplane flights in which Thompson Valves were used.

TO BREAK THE WORLD'S ALTITUDE RECORD



89 degrees below zero in June! Even the most imaginative arctic explorer could not match a story like that. Yet a thermometer on the wing of his Wright Apache recorded this temperature on June 4th, 1930, when Lieutenant Soucek, indomitable Navy flyer, set the present world's altitude record for land planes—at 43,166 feet!

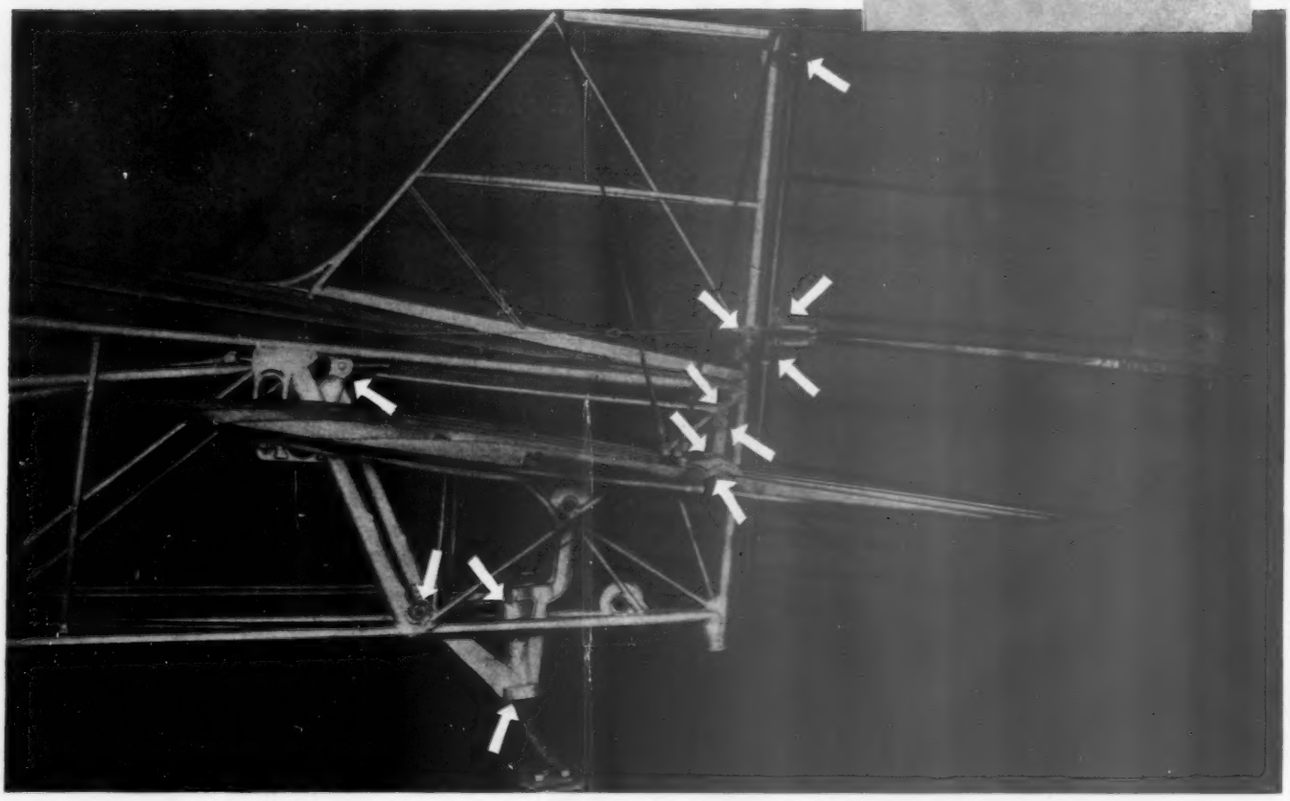
Two hours in the air . . . climbing steadily . . . Lieut. Soucek forced his Pratt & Whitney Wasp-powered biplane higher and higher . . . till beyond 42,000 feet his propeller began to fan the thinning air without taking hold. Wearing a self-developed breathing apparatus and electrically heated goggles, Soucek went upward doggedly to the new record—and even in the engine-warmed cockpit of the plane his thermometer was registering 38 degrees below zero!

But the 9-cylinder "Wasp" performed faultlessly, adding again to its long list of achievements. And in that engine, at the heart of its smoothly reliable performance, were valves supplied by Thompson Products, Inc.

THOMPSON PRODUCTS, INCORPORATED
General Offices: Cleveland, Ohio, U. S. A.
Factories: CLEVELAND and DETROIT

Thompson Valves

Plane Controls
...all Ball Bearing



100 Fafnirs on new Consolidated Trainer for smoother operation and lower maintenance

CONTROL system, landing gear, axle ends, brake controls, stabilizer adjustments and a majority of the other moving parts of the new Consolidated Trainer developed for the U. S. Army Air Corps function friction-free and service-free on 100 Fafnir Aircraft Bearings. This wide-spread use of ball bearings on a plane of this type demonstrates the fact that the advantages of smooth and dependable operation, elimination of costly servicing, and saving of weight and space made possible with Fafnirs, need not be confined to costly ships.

The wide range of types and sizes of Fafnir Aircraft Bearings, including seal and cartridge designs, assures the choice of the correct bearing for every airplane service. Whether for engines or control systems there is a Fafnir Bearing possessing the proper characteristics.

Plane builders are finding, as Consolidated has found, that with ball bearing applications "functioning is greatly improved" and "maintenance troubles eliminated."

Fafnir Aircraft Data Sheets contain valuable and practical information concerning load ratings, dimensions, and recommended uses.

THE FAFNIR BEARING COMPANY,
NEW BRITAIN, CONN.

Atlanta Chicago Cincinnati Cleveland
Dallas Detroit Los Angeles Milwaukee
Newark New York Philadelphia

Safeguarding quality

FAFNIR BALL BEARINGS

BELLANCA *will be at Detroit*

WITH NEW ANNOUNCEMENTS ABOUT BELLANCA PLANES

BELLANCA leadership once more will be asserted at the National Aircraft Show in Detroit. Sales gains and popularity will not be the only basis of this claim. Bellanca performance records will again confirm the superiority of Bellanca planes. The new announcements to be made at Detroit by this company will also provide renewed evidence that Bellanca design keeps always to the forefront, always a step in advance of the needs of air transportation.

If you are considering the purchase of new equipment and comparing values now on the market, it will pay you to wait until you see the 1932 Bellanca exhibit at Detroit, unless you prefer to view these models under construction at the Bellanca factory, New Castle, Delaware, before March 28th, making the trip as the company's guest in one of its demonstration planes.

BELLANCA AIRCRAFT CORPORATION
New Castle, Delaware — Chrysler Building, New York
Bellanca Aircraft of Canada, Ltd., Montreal

BELLANCA

BUILT AS ONLY BELLANCA CAN BUILD

SIZING UP
this industry of ours

THIS year the National Aircraft Show at Detroit, April 2-10, and the Annual Show Number of AVIATION will for most interested people definitely indicate the place occupied by the airplane in the American economic scheme. The business man, the investor, the potential user will, at Show time, critically size up the present-day industry, its products, its leadership and prospects.

For those who attend, the April issue of AVIATION will provide a guide to their general interests and contacts at the Show. It will contain a list of exhibitors, forecast of exhibits, program of meetings and other useful information. In addition it will present a consensus of opinion of current problems by outstanding executives of the industry. The advertising pages will reflect the confidence of prominent manufacturers who serve the industry.

To the thousands who are unable to go to Detroit, the Show Number will be equally interesting. More than twenty thousand copies will be printed for subscribers and newsstand buyers.

Advertising forms will close March 18; three days earlier for color.

Annual Show Number—April

AVIATION

1882 *Golden Anniversary* 1932

FIFTY YEARS

IN THE FRONT RANK OF PROGRESS

In dim geologic ages, Nature created beneath an exclusive area in northwestern Pennsylvania her supreme achievement in petroleum —the rare crude oil containing astounding lubricating qualities and now known as the "Bradford" Grade. Fifty years ago, Kendall Oil was first refined from this famous crude. Throughout the fifty years since, it has been derived from no other source.

In perfection, Kendall refining processes have been in keeping with the fine quality of the crude. No acids or harmful chemicals endanger the final goodness of the oil. No expense or effort is spared to make each drop of oil pure, uniform, capable of unusual service.

During this eventful half century, which has seen the development of high-speed industrial machinery, the automobile and the airplane, Kendall Oil has kept pace with the need for friction-resisting, enduring, efficient lubrication. Aviation, like other industries, has learned the net worth of Kendall. It has experienced Kendall's abundant fulfillment of every task.

On its Golden Anniversary, Kendall extends its appreciative thanks to those progressive men and women in aviation, whose confidence and support have led it to new triumphs and greater service.

Kendall Oil is sold at leading airports throughout the nation. Write for the list of these together with complete details of Kendall quality. Address, Kendall Refining Company, Bradford, Pennsylvania.

• • •

Visit the Kendall Exhibit at the Detroit Show—April 2nd to 10th. That happy character "Old Man Kendall" will be on hand to renew acquaintances and answer slippery questions.

The Kendall Refinery in 1885 and its entire crew of five men—including the teamster. The white building housed the steam plant. Behind it is the "cheese box" crude still. The two-horse team and wagon was the only "pipe line" from the wells.

KENDALL OIL REFINED FROM 100% BRADFORD GRADE OF PENNSYLVANIA CRUDE

Use the Air Mail!

Do you know that . . .

each month our subscription department receives more than 150 requests for "Back" issues of AVIATION?

◆ ◆ ◆

If we printed extra copies of our monthly issues, we would be glad to comply with these requests, but unfortunately we have no way of knowing in advance just how many of our newsstand readers will "miss" an issue.

◆ ◆ ◆

But We Do Know **— that each of these requests indicates a reader has "missed" just the issue he could make valued use of.**

Insure your receiving AVIATION *regularly by filling in the coupon below, today . . .*

AVIATION
330 W. 42d St.
New York City

◆

Subscription Rates:
United States and Mexico, $3 a year;
Canada (including Canadian duty), $3.50 a year;
Central and South America, $6 a year;
All other countries, $8 a year.

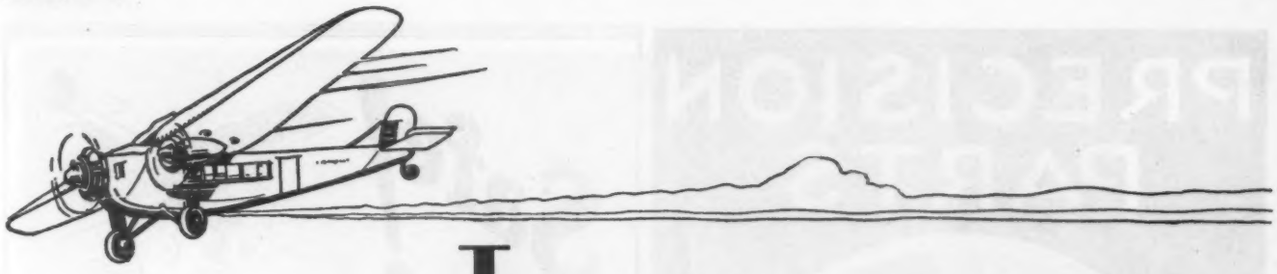
Here is my check for $3.00. Send me Aviation for one full year.

Name .....

Address .....

City and State .....

Nature of Activity .....



Long-wearing
NICKEL CAST IRON CYLINDERS

Nickel Cast Iron airplane engine cylinder mfd. by S. CHENEY & SON, Manlius, N. Y.

•

Some important airplane engine builders using

NICKEL CAST IRON

AEROMARINE PLANE & MOTOR CO.
Keyport, N. J.

AERONAUTICAL CORP. OF AMERICA
Cincinnati, O.

CONTINENTAL AIRCRAFT ENGINE CO.
Detroit, Mich.

LAMBERT AIRCRAFT ENGINE CO.
Moline, Ill.

MENASCO MOTORS INC.
Los Angeles, Cal.

MICHIGAN AERO-ENGINE CORP.
Lansing, Mich.

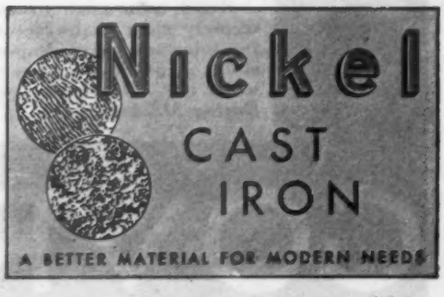
SZEKELY AIRCRAFT & ENGINE CO.
Holland, Mich.

WRIGHT AERONAUTICAL CORP.
Paterson, N. J.

give dependability to airplane engines

• It's no easy task to produce satisfactory cylinders for air-cooled airplane engines. The light fins cast integral as well as the heavier sections must be strong and dense, without any tendency to chill or become brittle. Machinability and wear-resistance are also highly important requirements. • Nickel Cast Iron... the modern Nickel alloy that is now standard cylinder material in about a dozen important American airplane engines... provides such essential characteristics as uniform hardness, high wear-resistance and good machinability. The possibility of warpage is eliminated... engine performance is improved. • By using Nickel Cast Iron in place of forged cylinders in 8-cylinder engines, one manufacturer reports that he has saved approximately 80% in the cost of the finished cylinders, while the total engine weight has been increased only 5%.

Our casting specialists will gladly discuss your problems with you.



THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

Miners, refiners and rollers of Nickel. Sole producers of Monel Metal

DISTRIBUTORS

United States

ATLANTA.....J. M. Tull Rubber & Supply Co.
BUFFALO.....Whitehead Metal Products Co. of N. Y., Inc.
CAMBRIDGE..Whitehead Metal Products Co. of N. Y., Inc.
CHICAGO.....Steel Sales Corp.
CINCINNATI.....Williams and Co., Inc.
CLEVELAND.....Williams and Co., Inc.
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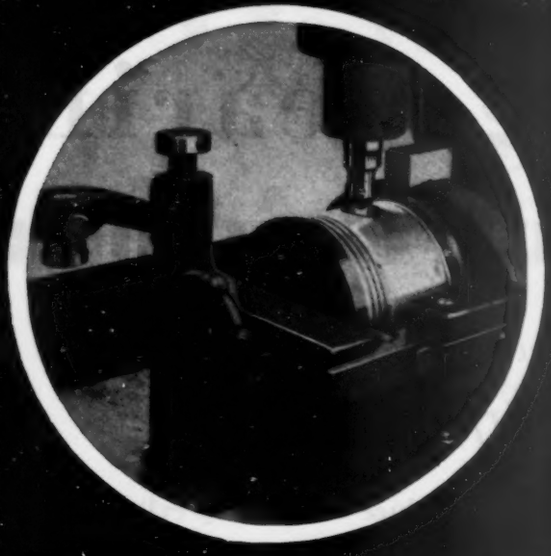

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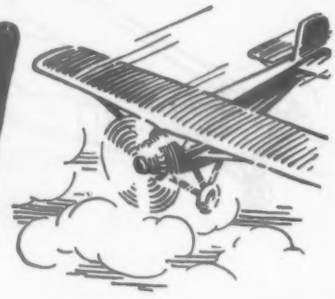

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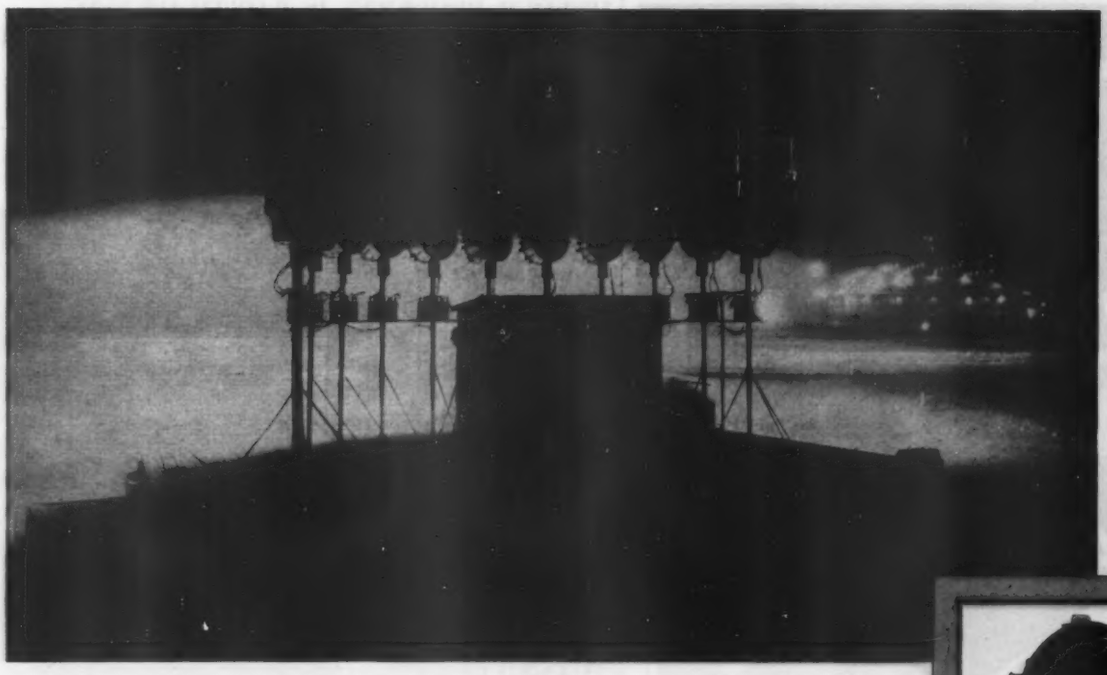

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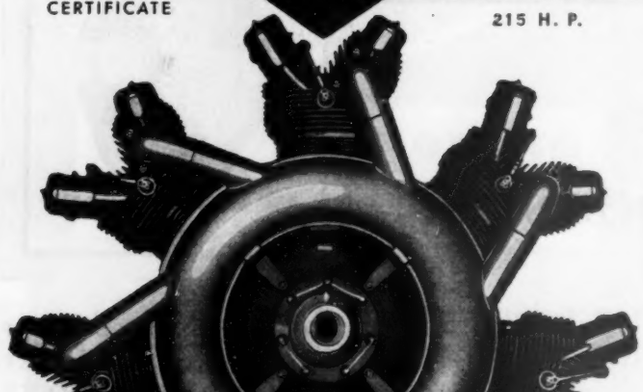

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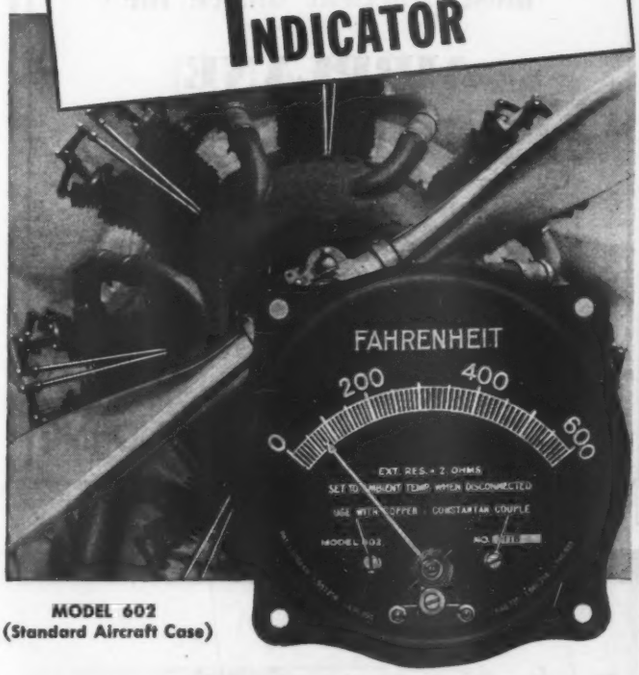

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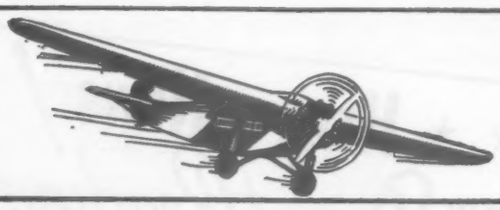

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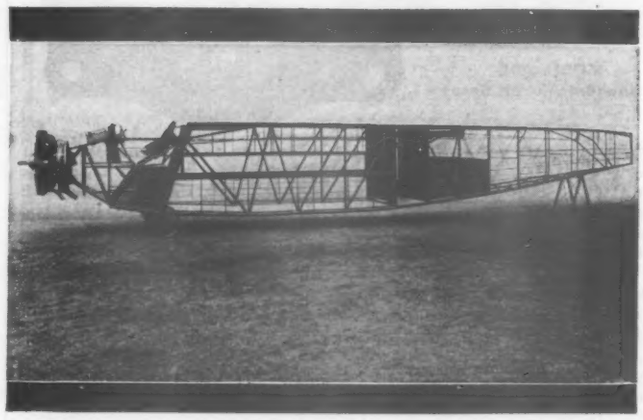

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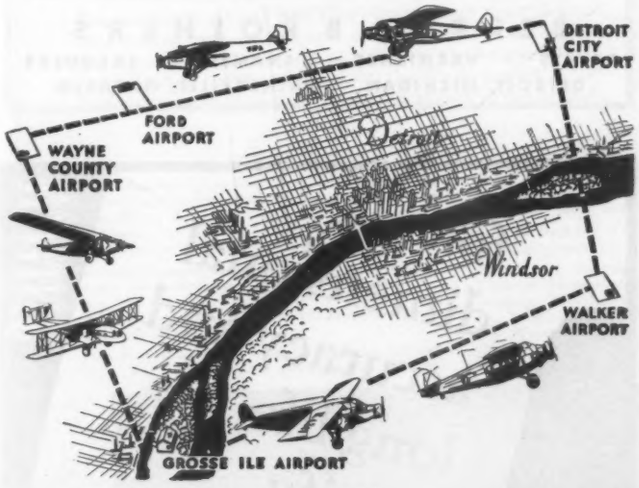

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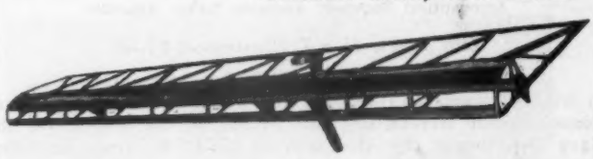

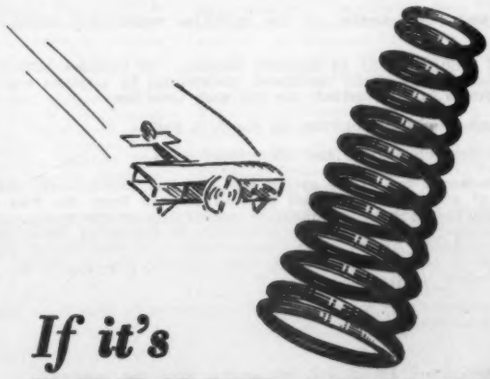

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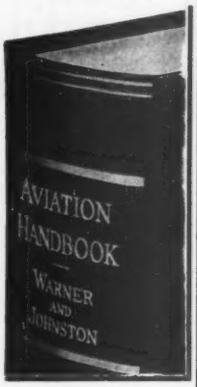

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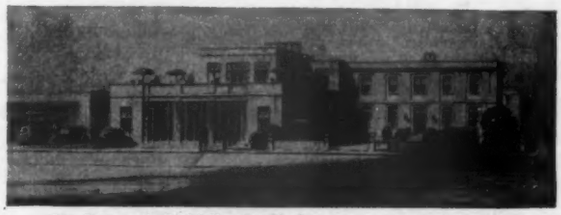

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WACO cabin demonstrator, perfect, $3,900. Three OX-5 motors, $125, one with complete overhaul. New York Aircraft Distributors, Inc., Brooklyn, N. Y.

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WANTED: Right wing of American Eaglet, also right front strut, rear front strut, jury strut. Clement J. Peront, 123 Webster St., Manchester, N. H.

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New Stearman Business Speedster C-3B Demonstrator. Wright Whirlwind 240 hp. Beautiful vermilion and maize paint job. Lots of extras. Top speed 133 m.p.h. 1,000 ft. per minute climb. Landing speed 42 m.p.h. Ideal plane for the particular business man who flys and wants the best. Factory list $8,500. SPECIAL $4,800.

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Owing completion of advertising contracts involving its use, our PCA2, 300 hp. J6E Autogiro is for sale, either on strictly cash basis or in trade on high speed open ship which we will need for other advertising work. Autogiro, including landing gear and rotors, completely overhauled by Pitcairn factory December. Motor also had complete general overhaul at Wright factory same time. Machine always received expert care and has never either been cracked or suffered slightest damage to vanes since purchase.

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Above ships are licensed and in good shape.

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J4 220-hp. straight wing Whirlwind Waco licensed and in perfect condition. Ship well streamlined and plenty fast. No reasonable offer refused.

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A real buy. Warner 110 H.P. Inland Super-Sport 2 Place Side by Side Ship

This ship is the same as brand new. Wonderful performing ship and loaded with instruments. This ship must be seen to be appreciated. Priced to sell.

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Seaplanes or Landplanes

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Two sets Edo De Luxe floats; one set used only 20 hours. All in perfect condition at bargain prices. Write or wire your offer.

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Warner Cessna in perfect condition. Motor completely overhauled. Will deliver and teach buyer to fly if desired. Write or wire:

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Like new. Steel prop., semi-air wheels, complete instruments. Special paint job. New August 1930—300 hours.

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CONSISTING OF:

2 Wright Whirlwind J-6 300 H.P. Motors; 3 J-5 220 H.P. Motors, completely major overhauled and test run; 2 Warner Scarab 110 H.P. Motors, same as new; 1 Wasp Series B, 525 H.P. Pratt & Whitney Hornet Motor, complete with propeller and starter; total time 150 hours, condition guaranteed perfect; 4 Rebuilt OX5 Motors; 2 brand new OX5 Motors in original crates; 1 Lycoming 215 H.P. Motor, condition perfect.

A Large Supply of New and Used J-4, J-5, J-6 and Warner Scarab parts, consisting of:

Crank cases, master rods, articulating rods, crank shafts, cylinders, pistons, piston pins, carburetors, new and used J-4, J-5 and J-6 Thompson valves, Hisso Waco Radiator, OX5 Waco Radiators, center section tanks for Waco, Waco Ailerons, wings, center section and tail group complete, also Pioneer compasses, bank and turns, Air speeds, Tachometers, etc. 2 J-5 Eclipse Electric Inertia Starters; 1 J-6 Eclipse Electric Inertia Starter; 2 J-5 Eclipse Hand Booster Starters, and 2 Warner Eclipse Starters; 3 J-5 Hamilton Standard Steel Propellers like new; 2 Brand new J-6 300 H.P. High Speed Hamilton Standard Steel Propellers; 2 Warner Steel Propellers, cannot be told from new; 4 new and used J-5 Hartzell Wood Propellers, complete with hubs. 1 Set of Edo DeLuxe Pontoons for Whirlwind Waco, perfect condition. 1 Russell Lobe 24 Ft. Parachute, same as new. Hundreds of other parts not listed.

All parts, motors and propellers shipped subject to inspection upon payment of twenty-five percent of purchase price on same.

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We will demonstrate and deliver FREE in New England or outside this territory for half expenses: ARISTOCRAT CABIN—165 hp. Continental—3 place Fast with top speed 125 mph. Motor and ship 136 hrs., always hangared. Licensed to July, 1932 .....$1700

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EAGLET—less 100 hrs. New Prop. Paintwork perfect $750

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Set includes two brand new wheels, two new tires and two new tubes.

Size		*Per Set*
24x4	Complete set of two	$19.00
26x4	Complete set of two	12.50
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New and Used Airwheels and Tires, also Semi-Airwheels. Write us for exceptionally low prices.
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J-5 Wright motor, ninety hours flying time..$550
Continental 40 H.P. practically new.....$275

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Ryan B-1, J-5 motor, 23 hours since overhaul. Re-covered last year, painted vermilion and cream. Steel prop., new upholstering. Ship never cracked. Licensed Sept. 1, 1932. **$1,650.**

Travel Air 2000, OX5 motor. 75 hours since new. Covering good, blue and silver color, duals, 30x5 wheels, licensed Feb. 1, 1933. **$750.**

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Buhl Bull Pup, Szekely 45 hp. 103 hours since new. Heavy wall crankcases. Painted vermilion and yellow. Air wheels and baggage compartment. Never cracked up. Licensed to June 1, 1932. **$750.**

New Buhl Bull Pup with Szekely motor. Flown only from factory. Same equipment as above Pup. Licensed to June 1, 1932. **$875.**

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Swallow TP, OX5 motor, turns 1400. Air wheels, new prop., covering good, licensed to Feb. 15, 1933. **$500.**

Swallow TP, OX5 motor, turns 1400. Always hangared, never cracked, licensed to April 15, 1932. **$400.**

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$25.00 AIRPLANE CHAIRS ONLY $4.95 EACH

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HERE'S WHAT THEY ARE

Light, Strong, Durable, Comfortable, (*very* comfortable), Distinctive, Even Beautiful! Unless I miss my guess, these few chairs will not last long. That is why you ought to send your order right now.

USE THEM

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Sold 80 of them in one month.

Have only 37 remaining when this was printed.

REMEMBER!

there are only 37 left and they are exactly like the illustration in natural Reed finish. You can have your chairs finished in green, old ivory or orange red, for only two dollars extra. These splendid, distinctive and useful chairs are being offered at approximately one quarter of their real value. Use the coupon below and get your order in while all colors are still available. (No charge for packing or crating.)

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Dear Ort: I sure would like to have some of your airplane chairs. Enclosed find $..... for which please express to me right away..... chairs as checked.

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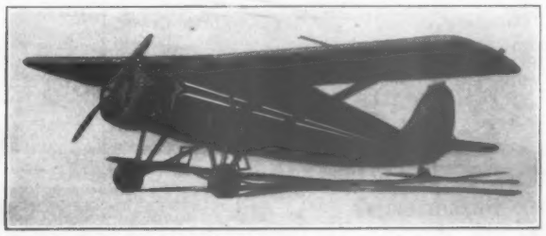

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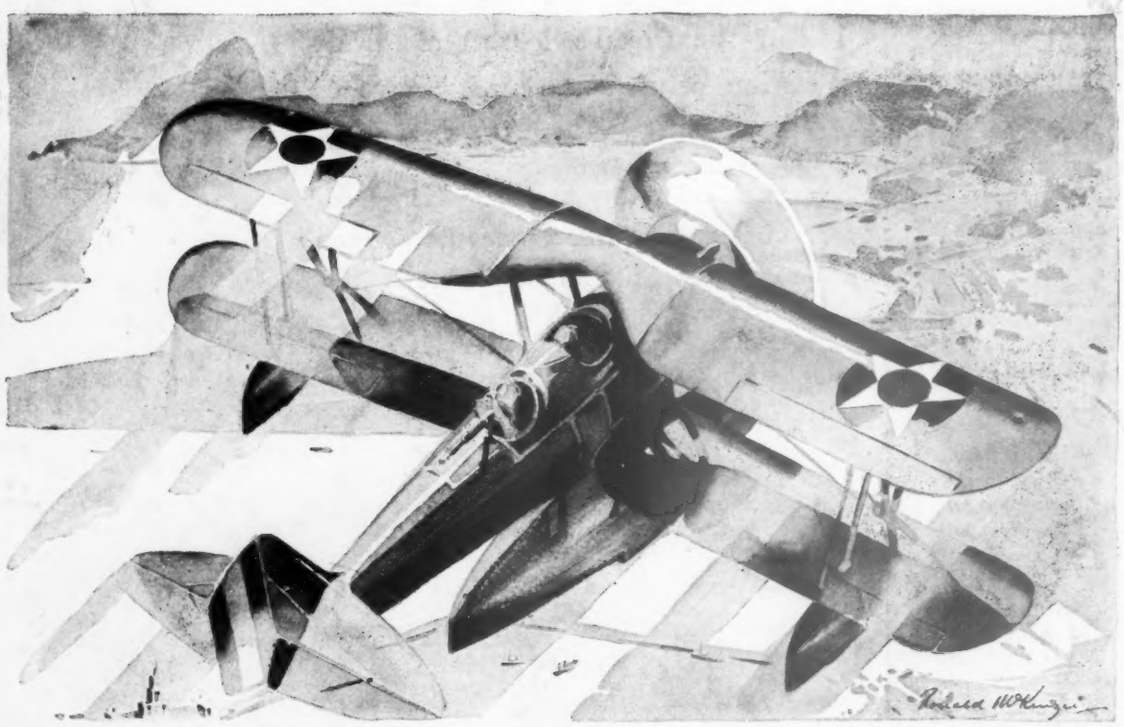

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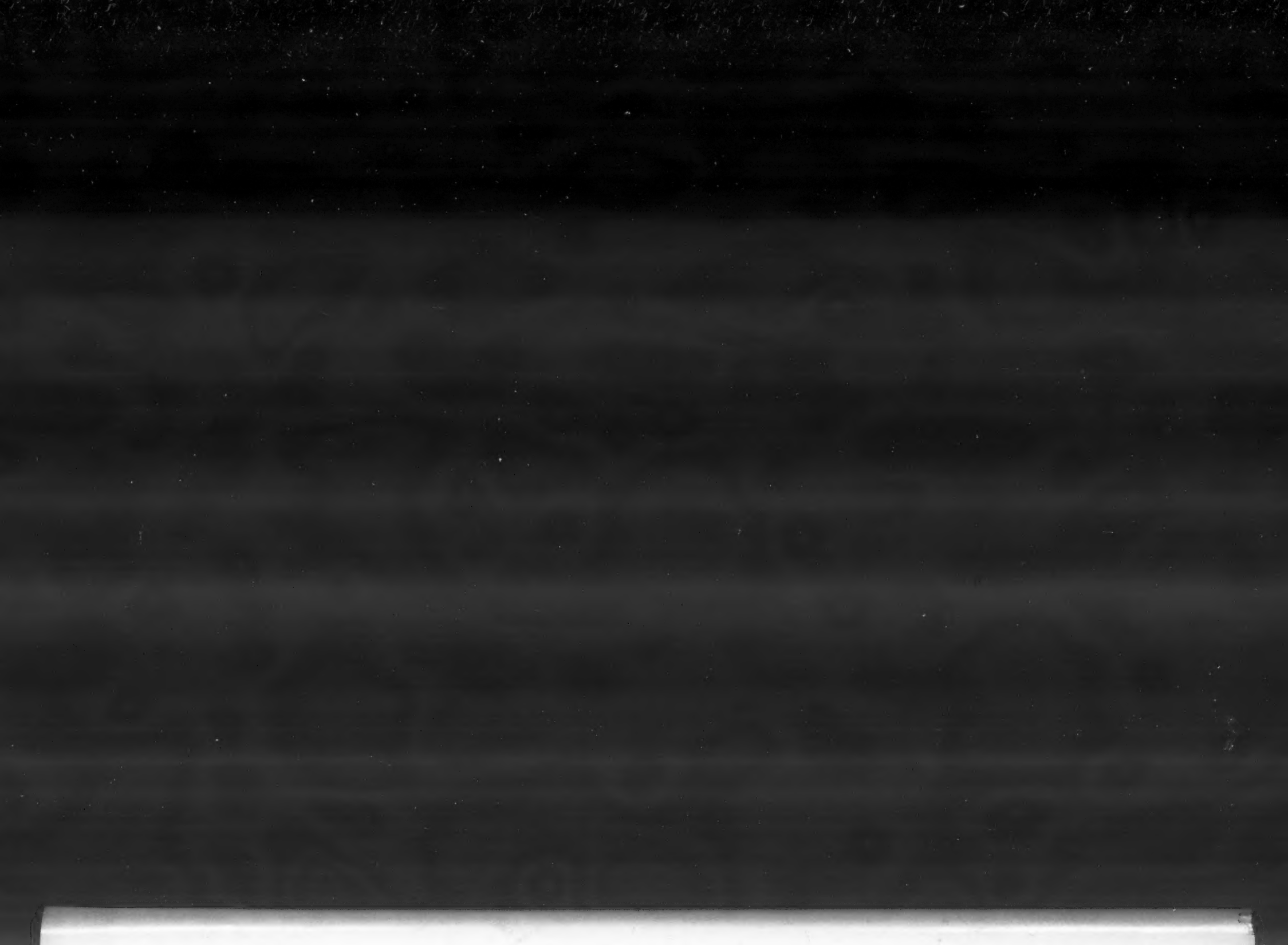
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